U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON TECHNOLOGY AND INNOVATION

HEARING CHARTER

Progress on P25: Furthering Interoperability and Competition for Public Safety Radio Equipment

Thursday, September 23, 2010
2:00 p.m. – 4:00 p.m.
2318 Rayburn House Office Building

I. Purpose

The Project 25 standard for digital land mobile radios is intended to further seamless communications interoperability among America's first responders, enable competition among radio equipment manufacturers, and provide for the efficient use of limited spectrum resources. In May of 2010, the Science and Technology Committee's Subcommittee on Technology and Innovation held a hearing to discuss the status of the Project 25 standard and the remaining challenges. This hearing will discuss these challenges further and explore how the status of Project 25 affects an array of stakeholders.

II. Witnesses

- **Mr. Tom Sorley,** *Deputy Director Radio Communication Services, City of Houston Information Technology Department*
- **Ms. Ellen O'Hara,** *President, Zetron*
- **Mr. Marvin Ingram,** *Senior Director, ARINC, Public Safety Communications*
- **Mr. Russ Sveda,** ***Manager of the Radio Technical Service Center,*** *Department of the Interior*

III. Brief Overview

In 1989, the public safety community joined together to address the lack of interoperability between digital radios supplied by different vendors through the development of the Project 25–or P25–technical standard for digital land mobile radios (LMRs). For over a decade, the P25 process made minimal progress in completing the standards. However, major disaster events (including the September 11th attacks and Hurricane Katrina) renewed motivation to drive the process forward and eliminate the

technical barriers that prevent public safety officials from different agencies and jurisdictions from communicating during an emergency response.

In a May 2010 hearing, the Subcommittee heard testimony on this progress, as well as on what some viewed as remaining challenges. For example, witnesses disagreed on the status of the P25 standards. Whereas witnesses representing two federal agencies claimed that many of the technical documents within the suite of P25 standards were not yet completed, those representing equipment manufacturers argued the standards were "functionally complete," enabling engineers to build interoperable equipment. Witnesses also debated the degree and rigor of testing that should be required to verify manufacturers' claims that radio systems are P25-complaint.

This hearing will continue the Technology and Innovation Subcommittee's examination of the P25 standard, and explore how the status of the standards documents and the testing requirements impact P25 stakeholders. This hearing will also review the role of the P25 standard in ensuring radio systems are interoperable and that there is competition among vendors.

IV. Background

Project 25

The lack of interoperability—often defined as the ability of emergency responders to communicate with whom they need to, when they need to, and as authorized—has long challenged America's public safety community. Interoperability problems between responding agencies were documented in the response efforts to the 1995 Oklahoma City bombing, the September 11th attacks, and Hurricane Katrina, making response efforts more chaotic, less efficient, and even more dangerous. In the World Trade Center attacks, firefighters did not receive the New York Police Department message to evacuate the building immediately, contributing to the deaths of those firefighters. In the response to Hurricane Katrina, officials in helicopters could not communicate with responders in boats, slowing rescue efforts. First responders in these cases, and other large-scale events, ended up employing message runners, which limited the flow of information to incident commanders.[1]

While planning, governance, and training are essential components of interoperability, standards-based technology is generally accepted as critical to achieving seamless interoperability either in an emergency or during day-today operation.[2] The emergence of digital technology in the late 1980s highlighted the importance of standards in ensuring interoperability. These digital radio systems used proprietary protocols and

[1] Tristan Weir, *Federal Policy Toward Emergency Responder Interoperability: A Path Forward*. Thesis submitted for a Masters of Science in Technology Policy from the Massachusetts Institute of Technology, 2006.

[2]Department of Homeland Security, SAFECOM Program's Interoperability Continuum tool, available at: http://www.safecomprogram.gov/NR/rdonlyres/54F0C2DE-FA70-48DD-A56E-3A72A8F35066/0/Interoperability_Continuum_Brochure_2.pdf.

technology which, unlike their analog forbearers, were incompatible with the proprietary technologies of other vendors, even when those radios were deployed within the same spectrum band.[3]

In 1989, to escape proprietary systems and promote interoperability, the Association of Public-Safety Communications Officials (APCO) and the National Association of State Telecommunications Directors (NASTD), along with several federal agencies, began work on the P25 suite of standards for digital LMR systems. The originators of P25 sought to develop a user-defined and user-driven standard that would allow for interoperability, multi-vendor procurement, and the transition from legacy analog equipment to digital equipment, as well as promote greater spectrum-use efficiency.[4]

The APCO process eventually led to a partnership between the public safety community and the Telecommunications Industry Association (TIA)[5] to collaborate on standards. Through a process agreed to by TIA and the participating representatives from the public safety community, public safety users define the requirements for the standard and the standards documents are then produced by engineers from TIA and digital radio manufacturers who volunteer their expertise.

Representatives from several federal agencies were among the original participants in P25. However, the slow rate of progress toward greater interoperability spurred Congress to direct the Department of Homeland Security to take a more active role in promoting interoperability and hastening the development of the P25 standards. The 2004 *Intelligence Reform and Terrorism Prevention Act* (P.L. 108-458) directed the Secretary of Homeland Security to establish a program to improve the state of interoperable communications capabilities for first responders. Among other requirements and activities, the legislation directed the Department of Homeland Security to work—in consultation with NIST, the private sector, and others—to "accelerate the development of national voluntary consensus standards for public safety interoperable communications." Since the passage of the Act, NIST, through the Public Safety Communication Research Program (a joint program between NIST and the National Telecommunications and Information Association), has taken leadership roles in the P25 standards development process, particularly in areas of testing and certification.

A 2007 Government Accountability Report (GAO) report[6] noted that, despite over $2 billion of federal spending to advance interoperability, communities across the country were still far from achieving that goal. GAO identified a number of barriers to interoperability, but also cited the slow rate of P25 standards development as among the factors hindering faster adoption of interoperable public safety communications systems.

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[3] COPS Interoperable Communications Technology Program, May 2007 Issue Brief, *Project 25:The Quest for Interoperable Radios*, by Dan Hawkins, available at: http://www.dps.mo.gov/homelandsecurity/documents/SEARCHP25Primer.pdf.

[4] *Id.*

[5] The Telecommunications Industry Association is an ANSI-accredited standards development organization.

[6] GAO Report 07-301, April 2007. *First Responders—Much Work Remains to Improve Communications Interoperability.*

GAO noted that while the P25 standards developers took four years (from 1989 to 1993) to develop the Common Air Interface (defined below), they did not complete any additional standards between 1993 and 2005. GAO found that P25 participants had made "significant progress" on the standards for interoperability after 2005, but that many standards were still incomplete. Further, GAO reported that tests conducted between 2003 and 2006 showed that inconsistent interpretations of the standards caused P25 radios to fail aspects of interoperability tests.

P25 encompasses a suite of standards, each of which defines the technical requirements necessary for components of the radio system infrastructure to interface—or interoperate—with one another. Public safety land mobile radio (LMR) systems include the portable handheld and car-mounted radios used by emergency responders, as well as fixed infrastructure such as towers, base stations, and console. Those P25 standards identified as most critical to interoperability are listed below:[7]

- **The Common-Air Interface (CAI)**, which defines the communication protocols between radio transmitters and receivers. This standard is intended to ensure that a portable radio from one manufacturer can communicate with a portable radio from a different manufacturer.
- **The Console Subsystem Interface (CSI)**, which defines how radio frequency components of the system and console (such as the equipment used by dispatchers) connect with one another.
- **The Fixed Station Interface (FSI),** which defines how components of the radio system that are fixed in place (such as base stations) connect with other components of the system.
- **The Inter-RF subsystem Interface (ISSI),** which defines the connection between different radio system networks.

Compliance Assessment Program (CAP)

Standards are technical documents, but engineers may vary in their interpretation of the protocols included in the documents. Ultimately, this variability in interpretation can impact the functionality of equipment. For this reason, in the case of many telecommunications standards – such as Wi-Fi or BlueTooth, the relevant industry stakeholders develop testing and certification processes to ensure products meet the specifications of the standards and that the standard is being interpreted consistently among vendors.

For many years P25 lacked a formal testing process to validate that manufacturers had correctly and uniformly implemented the standards in their equipment and were not misappropriating the P25 label. In 2005, in response to reports of failed interoperability tests of P25-labeled equipment (between different manufacturers, and even between

[7] COPS Interoperable Communications Technology Program, May 2007 Issue Brief, *Project 25:The Quest for Interoperable Radios*, by Dan Hawkins, available at: http://www.dps.mo.gov/homelandsecurity/documents/SEARCHP25Primer.pdf.

different models from the same manufacturer), Congress directed the Department of Homeland Security (DHS), working with the Department of Justice (DOJ) and the National Institute of Standards and Technology (NIST), to develop a P25 Compliance Assessment Program (CAP).[8] The DHS CAP certifies laboratories and specifies which tests must be conducted to show compliance with the standard. The DHS CAP is a voluntary program, but any P25 digital radio systems purchased with DHS grants must meet the requirements of the program.

The P25 CAP sought to specify testing requirements for performance, interoperability, and conformance.[9] Conformity assessment tests whether manufacturers have correctly and consistently interpreted and implemented the standard. It is generally more rigorous than interoperability and performance testing and it is arguably the best mechanism for ensuring that all standardized functions will interoperate across all manufacturers. Conformance testing is also considered particularly important in ensuring backwards compatibility of new technology, which must connect and interoperate with legacy systems, some as many as 20 years old or older.

May 2010 Hearing

On May 27, 2010, the Subcommittee on Technology and Innovation of the House Committee on Science and Technology held a hearing on the status of interoperability for public safety communications equipment. The Subcommittee heard testimony from the public safety community, federal agencies, and major manufacturers of radio equipment.[10] The hearing addressed the status of the P25 standards and the degree of testing needed to ensure that P25 products conform to the applicable standards.

The witnesses made different arguments on the scope of P25 and the impact the status of the process had on digital radio equipment being fielded today. Witnesses from DHS and NIST identified eight interfaces (i.e., standards) encompassed by P25, and according to NIST's testimony, only one and a half of the eight interfaces were complete. The witness testified that:

> *To date, only the conventional portion of the CAI and the Inter-RF-Subsystem Interface have a completed suite of documents[11] . . . The more complex trunked[12] CAI continues to lack*

[8] Directed in the *FY2006 Department of Homeland Security Appropriations Act* (H. Rept. 109-241)

[9] *Charter for the P25 Compliance Assessment Program, April 2008*, available at: http://www.safecomprogram.gov/NR/rdonlyres/D295A545-44A4-4226-AAF7-56A33684908E/0/Project25ComplianceAssessmentProgramCharter.pdf

[10] Witnesses at May 27th Hearing: **Dr. David Boyd**, Director of the Command, Control, and Interoperability Division of the DHS Science and Technology Directorate; **Mr. Dereck Orr**, Program Manager for public Safety Communication Systems, at NIST; **Dr. Ernest Hofmeister**, Senior Scientist at the Harris Corporation; **Mr. John Muench**, Director of Business Development for Motorla, Inc.; and **Chief Jeffery Johnson**, President of the International Association of Fire Chiefs, and Chief of Tualitin Valley Fire and Rescue, Aloha, Oregon.

[11] From testimony provided by Dereck Orr: for P25, each complete interface, or standard, includes five documents--a protocol document, which provides the details to implement the particular interface, and three test documents (tests for performance, interoperability, and conformance), which allow manufacturers

conformance test documents . . . although trunked CAI products have been sold for almost a decade. The remainder of the six interfaces is in various stages of document completion.

The witness further testified that because the P25 standards remain incomplete, radio systems that are sold as P25 are in actuality only partially standards-based.

LMR industry representatives did not dispute that P25 was technically incomplete, but they stressed that the standards needed to change as technology evolved and argued that the available standards actually enable interoperability across vendors. Motorola, a major manufacturer of LMR equipment, held that "the technical specifications for Project 25's Phase 1[13] systems are functionally complete." Accordingly, the industry representatives pointed out that the P25 standards documents completed to date enable two important functions: (1) ensuring that a P25 portable radio can communicate directly with any other P25 portable radio in the same spectrum band; and (2) allowing a first responder, within the coverage area of a neighboring network, to communicate with his/her home network (e.g., dispatchers) through the neighboring network.

The manufacturer representatives also noted that P25 developers have generated approximately 69 published standards, with an additional 13 in the ballot phase and 15 in the draft phase. Given that the standards development process relies on the voluntary efforts of expert engineers, and consensus amongst all of the stakeholders, Harris' testified that "the standards pace is at full industry and user capacity."

Witnesses at the hearing also disagreed about the degree of testing that should be required to validate that products meet the standards. NIST testified that the CAP attempted to create a rigorous and formal testing program, while minimizing the burden the testing requirements would impose on industry. NIST noted that not only does the CAP not require third-party certification, CAP developers leverage the testing standards developed and published by the P25 standards developers themselves.

Federal Government witnesses also noted that, although the CAP as originally planned was to include interoperability, performance, and conformance testing for all completed interfaces, the first P25 CAP requirements (which were issued in 2008) did not include conformance testing. Those requirements covered only the CAI standard, which—at the time—was incomplete and included no conformance testing documents. NIST and DHS further testified that manufacturers strongly objected to a proposal to include conformity testing for the ISSI standard, which had a completed conformance testing document, in

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to "comprehensively test their implementations in a common way" to limit variants in interpretation of the protocol. All of these documents are developed via a consensus process.

[12] Trunked radios are considerably more complex than conventional. In a trunked radio system, users are not assigned to particularly frequencies, but instead have access to any frequency that is open, and are connected automatically via the system. Not being confined to assigned channels allows more efficient use of the frequencies because more users can be on the system at any given time.

[13] As noted in the testimony provided by Motorola and Harris, Phase 1 of Project 25 refers to enabling communication at bandwidth's of 12.5 kHz to comply with FCC "narrow-banding" requirements. Phase 2 will further reduce the width of the communication channel to 6.25 kHz in anticipation of future FCC mandates to use limited spectrum resources more efficiently.

the CAP in 2009. The agency witnesses voiced strong support for including conformance testing, arguing it was the best tool to ensure interoperability and backwards compatibility with legacy systems.

At the hearing, the manufacturer representatives noted that both of their companies follow rigorous internal testing procedure, and had worked extensively with other companies, and within the P25 process, to resolve identified interoperability problems. Harris noted that past interoperability problems reflected ambiguities within the P25 standards, which have subsequently been resolved, and should no longer pose problems. Motorola contended that any interoperability problems found today are likely a result of differences in equipment configuration between radio systems.[14]

While the manufacturers were supportive of the P25 CAP, they questioned whether the benefit of more rigorous testing would outweigh the cost. Both Harris and Motorola pointed to the costs of developing the needed equipment to perform the tests. They also noted that while conformance testing is routinely done in the telecom industry, the public safety equipment industry and market is significantly smaller and testing would therefore be more burdensome.

The charter, witness testimony, and webcast to the May hearing can be found on the Science and Technology Committee's website (http://science.house.gov/publications/hearings_markups_details.aspx?NewsID=2866). In addition, responses to Questions for the Record for that hearing, which are not yet published, are included in an appendix to this charter.

700 Mhz and Public Safety Broadband Networks

The P25 standards cover interoperability for voice communications over digital LMR systems. With the availability of broadband, many public safety agencies are seeking to integrate data functions into their operations. Generally, public safety agencies that seek to integrate these functions now must rely on commercial carriers to provide broadband service. However, the National Broadband Plan recommended the creation of a nationwide interoperable public safety wireless broadband network, which would allow data and extra voice capacity for public safety.

Many policy and technology issues may need to be resolved before more widespread implementation of public safety broadband networks is possible. In addition to questions

[14] As noted by NIST in response to Questions for the Record (located in the Appendix to this charter), methods for the configuration, or programming, of radios vary across manufacturers. Such programming is complex, and made more complex by the number of features present in a particular radio. The lack of standardized methods for programming can lead to interoperability, as well as operability, problems, particularly in an emergency response setting, where time is critical. However, NIST further noted that " . . . in discussions with public safety organizations responsible for the provisioning of radios operating on a system, we have been informed that many of the issues found in the radios also require software upgrades to the radios themselves rather than a simple reconfiguration. Thus we are confident that some issues found in the field are due to problems beyond configuration and programming, and are instead due to non-conformance to the standard or problems with the standard itself."

about the fate of the "D-Block" (an additional 10 Mhz of the 700 band spectrum) and debate on how to govern, finance, and build a network for public safety, significant issues arguably remain with respect to standards and testing. NIST and the National Telecommunications and Information Administration (NTIA) have worked with the public safety community over the past three years to define the technical requirements needed for a public safety broadband network. Working with the broadband industry, NIST and NTIA are also developing a test-bed to test broadband technology against public safety needs. Testing will begin early next year. Public safety-specific standards for broadband technology have not yet been addressed in an organized fashion.

V. Issues and Concerns

Even in their current state, the P25 standards have improved interoperability for public safety radios. LMR vendors have shown that handheld and portable radios from different manufacturers can communicate with one another. However, there are unanswered questions on whether further progress is still needed to address two key goals of the P25 process: (1) ensuring seamless and reliable interoperability, and (2) fostering competition for public safety communications equipment.

Although representatives from industry claim that the P25 standards are "functionally complete", concerns persist that currently fielded P25 systems are not completely standards-based. In addition, questions remain on the extent to which testing should be required to validate that products meet the standard.

Though there are clear disagreements over these technical matters, it is less clear what the consequences of these disagreements are for the interoperability of the equipment and for ensuring competition among vendors in the P25 equipment market. Further discussion of the practical impacts of these issues should help provide more insight into whether, and to what extent, the P25 process is meeting its original goals.

APPENDIX

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON TECHNOLOGY AND INNOVATION

HEARING ON

Interoperability in Public Safety Communications Equipment

May 27, 2010

Questions for the Record Submitted to:

Dr. David Boyd
Director, Command, Control & Interoperability, Science and Technology Directorate
Department of Homeland Security

Questions Submitted by Subcommittee Chairman Wu

(1) P25 equipment purchased with DHS grant dollars must follow the CAP testing and evaluation requirements. How does DHS monitor the grant programs to ensure that grantees follow this requirement?

Response: The DHS Office of Emergency Communications (OEC) and the Office for Interoperability and Compatibility (OIC) support SAFECOM's development of guidance, research, testing, and standards of communications technology. SAFECOM issues an annual document titled "Recommended Guidance for Federal Grant Programs" to provide a point of reference for Federal grant programs that fund interoperable emergency communications activities. The guidance is intended to ensure that Federal grant funding for interoperable communications aligns with national goals and objectives and ensures alignment of state, local, and tribal investment of federal grant funding to statewide and national goals and objectives.

The SAFECOM guidance specifically states that when a grantee procures P-25 equipment and systems they should, at a minimum, "ensure the vendor has participated in equipment testing consistent with the Project 25 Compliance Assessment Program (P25 CAP)"

FEMA/GPD acknowledges this guidance and incorporates it by citation into all grant guidance and application kits, "States that are using FY 2010 HSGP funds to purchase Interoperable Communications Equipment…must consult SAFECOM's coordinated grant guidance, which outlines standards and equipment information to enhance interoperable communications."

FEMA/GPD does not monitor its grantees to ensure they follow the P25 CAP requirement. However, in an effort to assist grantees purchasing communications equipment, information related to the P25 CAP has been incorporated into the Responder Knowledge Base (RKB) website, which maintains the DHS Authorized Equipment List. P25 vendors can now include test result summary reports and a Supplier's Declaration of Compliance (SDoC) on the RKB for grantees to reference.

The grant program that most directly addresses the P25 CAP is the Public Safety Interoperable Communications (PSIC) grant program, which is administered by both FEMA/GPD and the National Telecommunications and Information Administration (NTIA). Approximately 90

percent of all available PSIC funding ($848 million out of the available $968 million) is being used by grantees to acquire and deploy equipment to improve interoperable communications.

As background, the PSIC Grant Program Guidance and Application Kit released in August 2007 stated that:

"Agencies purchasing Project 25 (P25) compliant equipment must obtain documented evidence from the manufacturer that the equipment has been tested to and passed all of the applicable, published, normative P25 compliance assessment test procedures for performance, conformance, and interoperability as defined in the "Grant Guidance—Project 25 Explanatory Addenda," which can be found at www.safecomprogram.gov/SAFECOM/grant/defaults.htm."

In June 2009 with the designation of the initial eight laboratories approved to test equipment under the P25 CAP, PSIC program managers and officials from the Office of Emergency Communications (OEC) met with the National Institute of Standards and Technology (NIST) Office of Law Enforcement Standards and received guidance on the program. The PSIC Grant Program included language in its technical assistance offering in the National Preparedness Directorate Technical Assistance Catalog.

(2) Acknowledging that P25 is a work in progress, at the end of his testimony, Dr. Hofmeister suggested that defining the standard functions and features included within a "package" may offer public safety a clearer picture of the functionality of the LMR systems they are choosing. What are your thoughts on this recommendation, or on other ways of providing agencies with a better window into the status of P25 and the implications the status may have on functionality?

Response: Defining the standard functions and features required to identify a product as P25 compliant would provide greater transparency to the public safety community. A common definition for the sets of features offered by manufacturers could be beneficial, but only if it better informs the public safety community's procurement process and defining these feature sets does not cause additional delays. When there is a common definition of features across manufacturers, public safety officials can directly compare equipment based upon its functionality and how it will meet their requirements. This transparency combined with a robust compliance assessment program, including conformance testing, will provide increased confidence that equipment will meet the needs of the public safety community. (Conformance testing demonstrates how equipment conforms to the standard and will interoperate with all compatible equipment that correctly implements the standard, including equipment that was not tested.)

The Office for Interoperability and Compatibility (OIC) and the National Institute of Standards and Technology (NIST) are actively working to provide more information on P25 to the public safety community. The P25 Document Suite Reference identifies the current status of the highest priority P25 standards. Manufacturers are also required to submit Suppliers' Declaration of Compliance (SDoC) and Summary Test Reports. The SDoC is the manufacturer's formal, public attestation of compliance with the standards for the equipment. The Summary Test Reports provide the equipment purchaser with a summary of the tests conducted on the equipment along with the testing outcome. All of these documents are available to the public safety community through the Federal Emergency Management Agency's Responder Knowledge Base Web site (https://www.rkb.us/) and through NIST's Public Safety Communications Research Program Web site (http://www.pscr.gov/).

(3) In your testimony you mentioned that there are products in the field that were built in the early phases of P25 and that these systems, though labeled P25, may not interoperate. How widespread is this problem and how well aware are public safety agencies that their older P25 systems may not interoperate with newer systems?

Response: There are more than 50,000 public safety agencies throughout the United States, each with its own local and state government regulations and requirements that can impact

interoperability. It is difficult to assess how widespread the problem is. Often responders do not know whether they can truly communicate until the need to interoperate with different agencies arises. Based on our work in the field, there is a perception in the public safety community that buying P25 equipment does not guarantee interoperability. The perception that P25 equipment does not interoperate has impacted the pace of adoption. The best way to ensure P25 systems can communicate and also improve the public safety community's confidence in these systems is to have a robust compliance testing program that includes conformance testing.

The Department of Homeland Appropriations Act, 2007, (P.L. 109-295, Title VI, §672(a) (October 4, 2006) amended the Homeland Security Act of 2002 (Act), by adding a new section 314 to that Act. Under section 314, codified at 6 U.S.C. 195, the Director of the Office for Interoperability and Compatibility is required to, among other things, in coordination with the Federal Communications Commission, the National Institute of Standards and Technology, and other Federal departments and agencies with responsibility for standards, support the creation of national voluntary consensus standards for interoperable emergency communications. P25 CAP provides a process through which equipment can demonstrate that it correctly follows the standard and is able to interoperate with other equipment following the standard. When interoperability testing is combined with conformance testing, the public safety community can be assured that equipment conforms to the standard and will interoperate with all compatible equipment that correctly implements the standard, including equipment that was not tested. Conformance testing helps provide increased confidence that equipment developed in the future will retain compatibility with legacy systems.

(4) One issue raised at the hearing was that some of the interoperability problems that have emerged were not due to a failure to conform or comply with the standard, but were due to configuration issues. Do you agree with this? What is the role of the of the P25 process and/or the federal government in ensuring that configuration issues do not hinder interoperability?

Response: Radio systems are complex and include many features and functions that need to be configured. The way a radio is programmed varies from manufacturer to manufacturer. When public safety practitioners respond to an emergency and attempt to use their own equipment to communicate with responders from different agencies they may be forced to reconfigure their radios. This effort can waste valuable time and expend limited resources during an emergency. Additionally, improperly configuring a radio can prevent interoperability. Configuration issues could be addressed either through the voluntary consensus process or directly by manufacturers.

To date, P25 has focused on standardizing interfaces instead of internal functions of equipment, such as the method for configuration. Communication standards focus primarily on standardizing the interfaces because that is critical to ensuring devices can communicate across manufacturers. Internal device functions allow for product differentiation and manufacturers are free to be innovative with their product as long as they correctly implement the interface, allowing for interoperability.

Question Submitted by Subcommittee Vice Chairman Luján

(1) I am glad to see that we are having this important discussion, and I look forward to working with you all and my colleagues on policy that supports effective, high-tech public safety equipment. As a border state, New Mexico is faced with unique public safety challenges. Can you elaborate on how interoperability can affect border security? How can we support interagency coordination as well as coordination with state and local governments on establishing interoperability standards and technology to assist border security efforts?

Response: Since its creation, the Office for Interoperability and Compatibility (OIC) has supported user driven processes such as P25. Recognizing the need for an open and transparent compliance process, OIC established a P25 Compliance Assessment Program Governing Board to represent the collective interests of organizations that procure P25 equipment. The Governing

Board consists of local, state, and Federal Government employees who are active in the operation or procurement of communication systems. Members of the Governing Board represent states and communities on the northern and southern border. Their input into the Governing Board helps ensure the work benefits interoperability on the border.

Questions Submitted by Congressman Peters

(1) First responders in Michigan and other border regions must be prepared to coordinate with foreign first responders should an emergency occur at border crossings. Has the effort to increase compliance and interoperability of public safety LMR systems included coordination with international entities, such as Canadian first responders and regulators?

Response: As part of its efforts to improve interoperability, the Office for Interoperability and Compatibility (OIC) is coordinating with responders from Canada. Representatives from OIC have participated in the Canadian Voice Interoperability Workshop to discuss the need to accelerate P25 standards and use a robust compliance process. Additionally, the P25 Compliance Assessment Program provides a universal method for testing for compliance to P25, which is used internationally.

(2) First responders in Michigan tell me that radio communication would be one of the most significant challenges in communicating with Canadian personnel in case of emergency and that they currently lack the capability to communicate in the event of a large scale disaster such as a tunnel failure or bridge sabotage at the border. Has there been any effort to develop or provide first responders at border regions with specialized shared radio units that would provide seamless cross border communication? Have government regulators worked with Canadian regulators to discuss how to create radios that would be interoperable and meet both countries' regulatory requirements?

Response: One of the goals of Office for Interoperability and Compatibility's (OIC) Multi-Band Radio (MBR) Project is the advancement of MBR technology to improve key communications between local, tribal, regional, state, and Federal agencies. To do this, OIC is collaborating with practitioners and industry to develop MBR technology that will enable a single radio to operate across disparate radio bands in use by the emergency response community in both the United States and Canada. OIC is funding the test and evaluation (T&E) of a single handheld MBR through three phases of pilot testing. Phase One involved T&E by U.S. and Canadian emergency response organizations along the Seattle/Blaine, WA border region and other Canadian emergency response agencies (e.g., Vancouver Transit Police) during the 2010 Olympics. During Phase Two, representatives of various emergency response disciplines in Michigan will use the MBRs, which have already been deployed and programmed. Upon the completion of full software development, OIC plans to conduct another pilot with cross-border potential in Phase Three with DHS's Customs and Border Protection in the Greater Detroit area. Pilot planning remains underway and is expected to include Canadian counterpart agencies. Additionally, OIC is collaborating with practitioners in Nogales, Arizona to conduct MBR T&E along the southwest border.

U.S. and Canadian regulators have a close working relationship and have worked together for many years to share radio spectrum along the border region. This is no simple task, as radio signals do not stop at the border and each nation has equal access to all radio spectrum. The State Departments of both Nations, the U.S. Federal Communications Commission, the National Telecommunications and Information Administration, and the Canadian spectrum regulatory body, Industry Canada, have all been actively engaged in solving regulatory issues, including the sharing of the radio spectrum along the border region.

Questions for the Record Submitted to:

Mr. Dereck Orr
Program Manager, Public Safety Communications Systems
National Institute of Standards and Technology

Question Submitted by Subcommittee Chairman Wu

(1) Acknowledging that P25 is a work in progress, at the end of his testimony, Dr. Hofmeister suggested that defining the standard functions and features included within a "package" may offer public safety a clearer picture of the functionality of the LMR systems they are choosing. What are your thoughts on this recommendation, or on other ways of providing agencies with a better window into the status of P25 and the implications the status may have on functionality?

Response: Public safety users today have great difficulty understanding what P25 is or means as they are procuring equipment. Part of that confusion stems from the fact that not all of the P25 interface standards are complete. Additionally, there is no set of standardized features required for a product to be labeled P25. The definition of a feature set required for the use of the P25 logo would give public safety increased confidence that a system labeled as P25 at least meets a minimum set of requirements and promotes interoperability.

Public safety users also benefit from the clear definition of each feature's completion status. With this information, public safety can determine which features of a system are truly standardized, and thus make better-informed procurement decisions.

In response to the absence of these initiatives within the P25 process, NIST and the Department of Homeland Security's (DHS) Office for Interoperability and Compatibility (OIC) have instituted the P25 Document Suite Reference (P25 DSR) and the P25 Compliance Assessment Program (P25 CAP). The P25 DSR identifies the current status of each of the five standards that make up the P25 interfaces. This information is updated following each P25 standards meeting, or faster as needs dictate. The P25 DSR can be found on the Public Safety Communications Research (PSCR) program's website (www.pscr.gov).

Addressing the lack of a standard feature set required for the use of the P25 label, NIST and the Department of Homeland Security launched the P25 Compliance Assessment Program, a voluntary program that allows P25 equipment suppliers to formally demonstrate their products' compliance with a select group of requirements by testing it in recognized labs. The output, Suppliers' Declarations of Compliance and Summary Test Reports, from the P25 CAP are available on DHS's Responders Knowledge Base website (www.rkb.us). All agencies (Federal, state, and local), however, have a unique set of requirements or operating conditions, and as such, each agency should require test information for those unique requirements, beyond those provided by the P25 CAP, during their procurement process (i.e., through Request for Proposals (RFPs), etc.).

(2) One issue raised at the hearing was that some of the interoperability problems that have emerged were not due to a failure to conform or comply with the standard, but were due to configuration issues. Do you agree with this? What is the role of the P25 process and/or the federal government in ensuring that configuration issues do not hinder interoperability?

Response: NIST does not know the degree to which configuration issues lead to radio problems in the field, but in our experience, the difficulty in configuring or programming a public safety radio, which varies from manufacturer to manufacturer, can be considerable. One variable that plays a large role in the complexity of radio configuration is the number of features incorporated into each radio. Additionally, each manufacturer has a different physical method of programming the radios along with a different software interface. In other words, there is no common method of configuring radios across multiple manufacturers.

This complexity, and the lack of a standardized method for programming radios across different vendors, can lead to operability and interoperability issues. However, in discussions with public safety organizations responsible for the provisioning of radios operating on a system, we have been informed that many of the issues found in the radios also require software upgrades to the radios themselves rather than a simple reconfiguration. Thus we are confident that some issues found in the field are due to problems beyond configuration and programming, and are instead due to non-conformance to the standard or problems with the standard itself.

That said, we do believe that configuration issues could become critical, hindering interoperability during an event where agencies from surrounding areas bring their own equipment into a response. If each radio used in an event requires configuration prior to use, and reconfiguration is complex and difficult, then the ability to communicate could become compromised.

If configuration issues are indeed contributing to interoperability issues, as has been identified by Mr. Hoffmeister, then it behooves those involved in the P25 process to address this issue given that the purpose of P25 is to standardize interfaces to facilitate interoperability.

Questions Submitted by Congressman Peters

(1) First responders in Michigan and other border regions must be prepared to coordinate with foreign first responders should an emergency occur at border crossings. Has the effort to increase compliance and interoperability of public safety LMR systems included coordination with international entities, such as Canadian first responders and regulators?

Response: Coordination among American and Canadian first responders is critical should an incident occur at the border. It is important that both American and Canadian public safety agencies are able to leverage P25 standards to increase confidence in interoperability among their systems. It is also important that PSCR and other Federal emergency communications agencies work closely with their Canadian counterparts.

For the last several years, PSCR staff have been invited to participate in the Canadian Voice Interoperability Workshop to speak on issues such as P25 and voice quality in land mobile radio systems. During these presentations, PSCR staff speaks to the status of P25 standards development and points out the fact that Canadian public safety agencies can also use the P25 CAP given the public distribution of the information. PSCR anticipates continuing its participation in such events as long as invited. In addition to direct participation in Canadian interoperability events, PSCR has committed to sharing all work product that can be shared publically with the Canadian first responder community.

In addition to this direct cooperation with Canada, other organizations are working directly on border interoperability issues with both Mexico and Canada. These organizations include the Department of Homeland Security's Office of Emergency Communications (OEC) and its Border Interoperability Demonstration Project as well as the National Public Safety Telecommunications Council's Border Issues Working Group.

(2) First responders in Michigan tell me that radio communication would be one of the most significant challenges in communicating with Canadian personnel in case of emergency and that they currently lack the capability to communicate in the event of a large scale disaster such as a tunnel failure or bridge sabotage at the border. Has there been any effort to develop or provide first responders at border regions with specialized shared radio units that would provide seamless cross border communications? Have government regulators worked with Canadian regulators to discuss how to create radios that would be interoperable and meet both countries' regulatory requirements?

Response: While PSCR works directly with the Canadian first responder community (through Industry Canada and the Canadian Interoperability Technology Interest Group), it does not work

with specific border agencies in either the US or Canada. Both DHS OEC and DHS OIC have direct relationships with their Canadian counterparts and are likely better informed to answer this question.

Questions for the Record Submitted to:

Mr. John Muench
Director of Business Development
Motorola

Questions Submitted by Subcommittee Chairman Wu

(1) One issue raised at the hearing was the difference between performing conformance testing while the product is in development and doing so after the product has been developed. Can you please comment on Mr. Orr's statement that testing during development meets conformance testing requirements if done with the "right" equipment and with a quality system in place? What is involved in developing the testing equipment and quality system?

Response: Any testing within the Department of Homeland Security (DHS) Compliance Assessment Program (CAP), be it Performance, Conformance or Interoperability testing, is required to be done in a lab that has been formally assessed by National Institute of Standards and Technology (NIST) and as a result, is formally recognized by the DHS CAP for specific types of testing, such as Conformance testing. The formal assessment of the lab includes providing the assessment team with Lab Management and Lab Quality manuals. These describe the management and quality practices of the lab. According to the NIST Handbook on CAP Lab Assessment, the assessment does not concern itself with the maturity of or adequacy of these practices. Instead, the assessment only ensures that evidence exists that these practices are documented by the lab and followed by the lab.

Mr. Orr's statement is based on an observation that conformance testing may occur in a recognized lab that is dedicated to DHS CAP testing or that conformance testing may occur in a manufacturer's "development" lab that is not dedicated to DHS CAP testing. Note that some types of conformance tests are intrusive to the physical product and so, it may be more practical to execute such tests in a product development lab that essentially "opens up" the equipment under test.

Mr. Orr's statement about "a quality system in place" means that if conformance testing is to be done in a development lab that is not dedicated to DHS CAP testing, the management and quality practices of that lab must meet the expectations of the NIST Handbook on CAP Lab Assessment in order for the development lab's test results to be accepted by the DHS CAP.

The nature of conformance testing is validation that the standardized messages are sent under specified conditions and that when standardized messages are received, the resulting reaction to the standard message content is as specified. Conformance tests require validation of specified stimulus conditions, specified message content and specified reaction to the message content. This requires test equipment that can capture messages exchanged, and display the message sequence and content.

The NIST Handbook for Lab Assessment identifies four categories of test equipment that may be used by a recognized lab for DHS CAP testing. For each category, the Handbook also identifies certain requirements for each category of equipment. During assessment, the lab is required to provide evidence supporting the categorization of the equipment to be used and to provide evidence that the equipment is meeting the requirements specific to that categorization.

Mr. Orr's statement about "done with the "right" equipment" means that the equipment used to produce the test results has been assessed and approved during lab assessment.

The quality system is a document describing the policies and practices of the lab intended to produce quality results. This documentation also typically describes how these policies and practices will be monitored and enforced. This documentation is created and maintained by the management of the lab and provided to the assessors during NIST lab assessment.

As previously noted, the NIST Handbook on Lab Assessment identifies 4 categories of test equipment:

- Commercial Off the Shelf (COTS) test tools - Test equipment is not modified in any way after purchase and prior to use.
- Modified Off the Shelf (MOTS) test tools - Test equipment is modified to some extend after purchase and prior to use.
- Custom test tools- Test equipment is not commercially available and is custom made for specific use.
- Open Source/Freeware test tools - Test equipment is available to the general public under an open source license agreement and is not modified prior to use.

Only test equipment falling into the "MOTS" or "Custom" categories requires any sort of development. In these cases, the developer determines the requirements for the test equipment imposed by the test methodology and using a documented design and development process, builds or modifies the equipment capabilities to meet the requirements of the test methodology. Once the custom or modified capabilities have been implemented, per the documented design and development processes, these capabilities are validated the against the design requirements prior to actual use.

(2) Acknowledging that P25 is a work in progress, at the end of his testimony, Dr. Hofmeister suggested that defining the standard functions included within a "package" may offer public safety a clearer picture of the functionality of the system they are buying. What are your thoughts on this recommendation, or other ways of better communicating the status of P25 to purchasers

Response: The reality of the P25 market is for P25 compliant products to be designed and manufactured for flexibility in order to meet the diverse mission needs of the users. Standardized packaging of P25 features is something that can be done, but in my opinion will not ultimately satisfy the end user requirement for better information on the status of P25.

Public Safety Practioners commonly ask for Project 25 status and feature information as outlined by these four questions:

1. What features are in P25?
2. Where can a definition for these features be found?
3. What features have been implemented by a manufacturer?
4. What features have been tested for multi-manufacturer interoperability?

The answers to four questions help them determine, what set of P25 features meet their specific communications needs, which manufacturers provide the desired set of P25 features that meet their specific needs and whether the desired P25 feature set has been successfully tested for interoperability with the desired manufacturers.

The answers to the first two questions can be found in the P25 Statement of Requirements document published by the P25 User Needs Subcommittee and in TIA-102 Standard documents. The Public Safety Practioners develop and publish the "P25 Statement of Requirements" themselves. Public Safety Practioners receive free access to the published TIA-102 Standard

documents through a special TIA web access. Normally, the TIA Standard documents have to be purchased.

Each manufacturer markets the information as to what features and functions their company has implemented in their product lines. Among the supported features and functions are those claimed to be compliant to the Project 25 standard. If this information is not readily available, purchasers can get insight as to which P25 features have been implemented by a manufacturer by issuing either a Request for Information or a Request For Proposal.

Information on which features and functionality have been tested for interoperability and between which manufacturers, has not been publicly available in the past. The driving force for formal interoperability testing is the DHS grant monies. The grant guidance outlines a requirement for manufacturers to produce a P25 Suppliers Declaration of Compliance (SDoC) and Summary Test Report (STR). These documents include the results of formal interoperability testing. Purchasers can obtain information describing what P25 functionality has been tested by which manufacturers by requesting SDoC/STRs from the manufacturers or obtaining them from the Responder Knowledge Base (RKB) website.

The P25 Standard will never be comparable to the 3G/4G or WIMAX standards when it comes to public recognition or when a user is looking for information. The P25 manufacturers are not selling equipment to multiple global cellular service companies--each with massive marketing departments, operating worldwide cellular networks. P25 manufacturers are not shipping hundreds of millions of hand held radios every year.

The P25 manufacturers sell products to a unique marketplace that values products based on the Project 25 standard and implemented to provide guaranteed performance, long-term durability, security and features necessary for mission critical communications. Project 25 actively involves and uses the input of Public Safety Practioners (Police, Fire, EMS personnel, as well as State, Local and Federal agencies) when determining the needs and the scope of the P25 standard. Public Safety Practioners are members of P25 committees, they can submit comments on draft P25 standard documents and they can attend meetings in person and on conference calls. They are free to comment on the priorities of the P25 standard. Public Safety Practioners have always been involved with the development of the P25 Standard. Although the P25 market is smaller, the involvement of the user community in the standard development enables an informed user community without the massive marketing departments like the cellular marketplace.

There have been discussions within P25 about structuring specific features into packages to make ordering easier with the assumption that this would make it easier for the purchaser to understand what he is purchasing.. One of the challenges of offering pre-packaged P25 features for ‘mission critical’ communications equipment and systems is that the size, mission and communication needs of public safety agencies vary dramatically. It is this variation that limits the value and utility of standardized feature packages.

The size of a public safety agency can vary from 6 officers to over 35,000 officers; who serve populations from a few thousand to a few million. This size variation impacts the features needed and how the system operates. The different communication needs of the fire fighter all geared-up with breathing masks at the fireground, the metropolitan patrol police officer walking a beat, the state trooper patrolling the highways at high and slow speeds, federal law enforcement patrolling remote borders and the military communicating at forts and bases require different communication features and operations. The frequency bands in which these agencies operate are different, with different FCC and NTIA licensing requirements that directly impact the design and operation of the equipment and system. These public safety practioners use some of the same P25 services and features but may also require services and features with special behaviors, or various combinations of features, services and accessories that make their operations unique. For example, federal law enforcement using P25 equipment have wireless security requirements that are not imposed on state and local users.

Motorola does not envision a future where there is just one model of a P25 radio, nor should there be a P25 radio limited to only the P25 features fully-defined by published P25 standards. Today, there are many radio models and configurations that are P25-complaint and also support other standards or proprietary operations. Manufacturers offer product tiers at different price points and are free to configure feature sets to meet particular marketplaces. A manufacturer offers feature variations that are marketed to meet the individual business opportunities for that manufacturer. Customers continue to request features for their equipment that are not part of P25.

It has been Motorola's experience that purchasers of P25 equipment are most concerned with the status of multi-manufacturer interoperability. Aside from having a defined TIA Standard, P25 purchasers want to know what features, with what P25 portable and mobile radios, are interchangeable with what P25 fixed radio systems. The only action that resolves this concern is documented interoperability testing. The faster more features are added to the P25 CAP interoperability test suites, the faster users will know the interoperability status of products that can meet their feature needs. The P25 CAP could be expanded to cover more features faster, if the expansion first focused on interoperability testing of functionally-defined features with follow-on testing expansion to include conformance testing of these same features. The current P25 CAP testing approach is more vertical in nature. The current approach defines conformance and interoperability testing feature by feature. This provides a complete testing profile by feature but slows the initial interoperability testing for all features. Conformance testing is part of P25, but it is not a substitute for interoperability testing.

Also, the current 'rule of 3' for posting interoperability testing maybe keeping some vendors from posting interoperability performance status on the RKB. The 'rule of three' requires that the P25 equipment from one vendor be interoperability tested with three P25 equipment vendors. It is difficult, and can take many calendar months, for multiple manufacturers to schedule interoperability testing considering the multiple product development schedules of P25 manufacturers. Motorola would suggest that the 'rule of 3' for posting interoperability testing results be relaxed, allowing posting results with just one other manufacturer, but maintaining the 'rule of 3' for equipment to be eligible for DHS grant monies.

Questions for the Record Submitted to:

Dr. Ernie Hofmeister
Senior Scientist
Harris Corporation

Questions Submitted by Subcommittee Chairman Wu

(1) At the end of your testimony you suggested that "there could be much progress is making sure that you define what those levels of [baseline and above] of interoperability are and make sure those are present, tested for and present in every product." What would be required to implement this type of product labeling?

Response: The intent of this comment was to reference one of the Harris recommendations in the written testimony that: "Agreement among public safety agencies on the features for interoperability, as defined by several levels of interoperability, would be beneficial. These levels could include: P25 Interoperability Capability 0 (baseline); P25 Interoperability Capability 1 (Capability 0 plus more features), etc. This grouping of interoperability capability features would make specification and testing of interoperability simpler, more efficient, and adaptable to the interoperability needs of various public safety agencies." Within the P25 suite of standards, there

is an array of mandatory and standard option features.[15] As the name implies, mandatory features are those features that must be included in every P25 radio and system product. For example, Unaddressed Voice Call is a mandatory feature for the conventional mode of operation and Group Call Voice is a mandatory feature for the trunked mode of operation. For the current published suite of P25 standards, there are approximately 10 mandatory conventional features and 13 mandatory trunked features. However, for standard option features, there are approximately 30 standard option conventional features and 34 standard option trunked features. A standard option feature is a feature that the user has the option of purchasing/deploying and the manufacturer has the option of providing in its P25 radio and system product. With the 10-13 mandatory features representing the most basic level of operation and the 30-34 standard option features variably implemented in public safety P25 systems according to the buying needs/requirements of the user and the manufacturers option to provide, the range of P25 features varies significantly from P25 system to P25 system. The reason for the relatively large number of standard option features is to allow flexibility for various size public safety agencies to implement systems with capability scaled to their needs from relatively small, lower capability to very large, high capability needs. While such flexibility is good to allow adaption to user needs, it does create challenges when attempting to define one or more standard interoperability profiles (levels of capability) that can be tested and practiced with high assurance that the needed interoperability will work well when needed.

It is Harris' view that with such variability and flexibility in P25 features supported, interoperability in terms of features/capability means something quite different from public safety agency to public safety agency and especially from smaller, more likely rural agencies to larger, more likely metropolitan agencies. As noted in the Harris written testimony, "although challenging and having been discussed a number of times by users and manufacturers in the P25 standards community, the array of P25 mandatory and standard option features could be grouped or packaged into levels of increasing capability; i.e., P25 Level 0 (baseline); P25 Level 1 (Level 0 plus more features); P25 Level 2; etc. This grouping of features could make the product marking of features supported and the P25 CAP testing of features packages more simplified and efficient." A similar grouping or packaging of features into levels or profiles of interoperability would reduce the large variability in terms of interoperability features supported to a reduced set levels or profiles. Such grouping of interoperability capability features would make specification, testing, and marking of interoperability capability simpler, more efficient, and adaptable to the interoperability needs of various public safety agencies.

Harris views that the steps needed to implement such a specification, testing, and marking of interoperability levels or profiles would include:

a. P25 knowledgeable public safety agencies working together for consensus to define the P25 features for several levels of interoperability capability. These levels or profiles could include: P25 Interoperability Capability 0 (baseline and probably just the mandatory features); P25 Capability 1 (Capability 0 plus more features); P25 Capability 2 (Capability 1 plus more features), etc. Harris would envision that there should be five or fewer capability levels.

[15] The official definitions of mandatory and standard option features are included in the Project 25 Statement of Requirements (P25 SoR, Mar 3, 2010 Approved Version) as:

- A Mandatory service, feature, or capability supported by the suite of P25 standards is to be supported by all P25 systems. Implementation of the so-designated services, features, or capabilities shall comply with the P25 standards defined by TIA.
- Likewise, a Standard Option service, feature, or capability is supported by the suite of P25 standards. The user has the option of deploying so designated services, features, or capabilities. Likewise, manufacturers have the option of offering so designated services, features, or capabilities. If deployed in a particular P25 system, implementation of the Standard Option shall comply with the P25 standards defined by TIA.

b. Once the Capability Levels are defined in item a, the P25 community (industry and users) would select or develop the interoperability test standards corresponding to the features specified in the Capability Levels. This could be a selection of a subset of tests in the current trunked voice interoperability and the conventional voice interoperability standards. For the higher level(s) of interoperability, it may be necessary to develop supplemental interoperability tests for the standards.
c. The results of item b could be provided to the P25 Compliance Assessment Program Governing Board for their consideration to incorporate into the formal P25 Compliance Assessment Program interoperability tests through a Compliance Assessment Bulletin (CAB).
d. The current or additional Recognized P25 Compliance Assessment Laboratories could be assessed as necessary and recognized for these Interoperability Capability Levels.
e. Manufacturer's products could then be tested in the P25 CAP Recognized Laboratories per the CAB.
f. Based on the results of the P25 CAP interoperability testing, the posted Summary Test Reports (STRs) and the Supplier's Declaration of Compliance (SDoCs) could reflect the Interoperability Capability Level(s) passed.
g. If desired, a suitable P25 Interoperability Capability Level sticker or marker could be developed and used to visually show the P25 Interoperability Capability Level of the subject P25 product.

This approach could be consistent with the testimony during the Hearing of Dr. Boyd, "The way we talk about standards is that there ought to be some core set of functionalities that we make sure remain in place. …. I think the manufacturers are working very closely with us to develop that core set of functionalities."[16]

(2) One issue raised at the hearing was the difference between performing conformance testing while the product is in development and doing so after the product has been developed. Can you please comment on Mr. Orr's statement that testing during development meets conformance testing requirements if done with the "right" equipment and with a quality system in place? What is involved in developing the testing equipment and quality system?

Response: As a preface before answering the question and specifically on ISSI conformance testing, Harris views ISSI conformance testing as a design verification method used on software subsystems during product development in engineering laboratories. Harris does conformance testing as part of product development in engineering laboratories and at various stages of development (e.g., unit test, integration test, and SVT) to verify subsystem design. The testing is less formal, but done. In general, Harris does not feel that repeating conformance tests on a formal basis after complete product development adds significant value compared to the effort required. Harris is on public record several times in comments[17,18] to the P25 CAP Governing Board regarding its position on formal P25 CAP ISSI conformance testing. That being said, Harris recognizes that the P25 CAP Governing Board issued a P25 CAP ISSI Compliance Assessment Bulletin (CAB) that specifies approximately 30 conformance and 27 interoperability tests and that this CAB is in effect.[19]

In terms of answering the question, Harris agrees with Mr. Orr's statement that there is a provision in the P25 Compliance Assessment Laboratory guidelines that would allow "recognized" conformance testing during product development if done with the "right" equipment and quality

[16] From 5.27 hearing transcript for Dr. Boyd statements at lines 874 and 883.
[17] Harris Comments on DHS OIC P25-CAB_ISSI_REQ—December 2009, Ernest L. Hofmeister, Harris Corporation, January 18, 2010.
[18] Harris Comments to DHS P25 CAP Governing Board – March 31, 2010, Ernest L. Hofmeister, Harris Corporation.
[19] P25 Compliance Assessment Bulletin, Baseline Inter-RF Sub-System Interface Testing Requirements, P25-CAB-ISSI_TEST_REQ, Office for Interoperability and Compatibility, US DHS, March 2010.

system in place. The Guide[20] "discusses an approach of integrating recognized P25 CAP compliance test activities with the Product Development organization design validation testing activities. However, in order for this integrated approach to be successful, the recognized P25 CAP laboratory and product development must ensure that the provisions of NIST Handbook 153[21] are completely satisfied."

While Harris continues to evaluate the integrated approach, Harris is concerned about the operational practicality of integrating the product development environment into the P25 Compliance Assessment Lab environment in compliance with the Guide and NIST Handbook 153 and the business investment impact to do so. The practicality and investment challenges include establishing the "right" test equipment (including software test tools) and the quality system per NIST Handbook 153.

a. "Right" Test Equipment

Regarding the "right" test equipment, for conformance testing for interfaces like the Common Air Interface (CAI) where commercial off-the-shelf test equipment like protocol analyzers and RF test equipment exists that can be readily validated per NIST Handbook 153, establishing the "right" test equipment is not a challenge. However, for conformance testing for interfaces like the Intra-RF SubSystem Interface (ISSI) where the ISSI product is primarily software and where commercial off-the-shelf software test tools that can be readily validated per NIST Handbook 153 do not exist, establishing the "right" test equipment is a significant challenge. Conformance testing for software products like the ISSI by its nature is tedious and labor intensive without some automated and validated test tool. Harris is not aware of such a tool, but maintains a high interest level in sources or information on such a tool. An R&D version of an automated tool has been offered by NIST, but it has not been validated to our knowledge and especially not per the NIST Handbook 153 requirements for software test tools. Similarly, an ISSI software test tool offered a small company, Valid8, has been evaluated by Harris. Our assessment is that while this tool is promising for the future, a sizeable amount of continued development, maturation, and validation would be required before it could be considered a "right" test tool. Harris and industry experience with software and products from R&D labs and small companies is that much effort is often required to finish the development to a product and to validate and then to support.

Harris also notes that formal ISSI conformance testing will likely not be a one-time event where tedious, labor intensive testing might be more supportable. As with many complex P25 products, Harris expects that ISSI product releases will occur over time with successive releases supporting more and more of the ISSI features. ISSI conformance testing would be required for each successive ISSI product release.

Harris cannot afford to be both an LMR P25 equipment manufacturer and a test equipment/tool manufacturer. The public safety LMR P25 industry is just not like the cellular industry where we understand formal conformance tests are done. The much higher product mix and the much, much smaller volumes means that Harris, and likely the industry, must do things differently than the cellular industry. The orders of magnitude difference in scale between the LMR P25 industry and the cellular industry was identified and discussed during the hearing.

Thus, for ISSI conformance testing, the lack of a validated, automated software test tool ("right" equipment) represents a significant practical technical and business investment challenge. This challenge applies independent of whether the formal conformance testing is integrated with

[20] P25 CAP Laboratory Testing: Guide for Integration With Product Development Organizations, issued by P25 CAP, June 26, 2009, file Integration of P25 lab testing with product development r10.pdf.
[21] NIST Handbook 153, 2009REV Edition, ―Laboratory Recognition Process for Project 25 Compliance Assessment,‖ Kurt B. Fischer and Andrew Thiessen, Editors, Office of Law Enforcement Standards, Electronics and Electrical Engineering Laboratory, National Institute of Standards and Technology, U.S. Department of Commerce, June 2009.

product development or whether it is done separate from product development after the product is complete in a recognized P25 CAP lab. Development and validation of an automated ISSI conformance test tool by the Public Safety Communications Research (PSCR)[22] program (or another NIST/OLES or NTIA/ITS) group or validation of a 3rd party tool by PSCR for use by industry is an area where the DHS (or PSCR, NIST/OLES, NTIA/ITS) could make a significant contribution toward reducing the burden on the small P25 industry consistent with their intent indicated in the statements of Mr. Orr during the hearing.[23] A rough order of magnitude (ROM) estimate for Harris to develop and validate an automated ISSI test tool is $1.4 MUSD with a recurring expense of about 10% to maintain the tool. This amount represents a substantial portion of the R&D cost to develop the ISSI product itself. In the resource constrained R&D environment, development of an automated ISSI test tool by Harris would require diverting critical software engineering resources from ISSI product development to test tool development. The result would affect Harris' ability to compete in the marketplace through reduced ISSI product innovation and longer time to market for ISSI features in order to implement formal ISSI conformance tests. Such an investment and diversion of resources would not be justified or acceptable for normal business considerations and practices and especially for the formal testing that Harris believes provides little added value or compliance assurance beyond that already provided by the normal in-formal conformance testing as part of product development.

b. Operational Practicality and Quality System

Harris understands the need for the rigor and careful formal control in the P25 CAP as defined in the Guide and NIST Handbook 153 for such testing to be recognized by DHS/NIST. While not impossible, the rigor and careful formal control is more challenging to implement for the case where the product development environment is integrated with the separate P25 CAP lab environment than when the P25 CAP lab is maintained as a separate and self-sustaining environment.

For Harris, the Product Development environment, while controlled, is very dynamic, flexible, fast-paced, and less formal with hardware and especially software changes rapidly implemented, tested, and revised leading to a final hardware and software configuration. The final hardware and software configuration is then released to the System Verification & Test (SVT) environment within the Product Integrity organization for more rigorous, controlled, and formal product and system verification testing. There is interaction and iteration between the SVT and product development groups for items found in SVT testing that could be problems or unexplained behavior leading to a final version of hardware and software that is releasable for products and systems. The SVT testing often extends over a period of months and usually includes Beta testing at one or more customer installations. Harris has formal product releases indicated as PR-AB-C and system releases indicated as SR-DE-F.

Establishing a Quality Management System for integrating elements of the product development and SVT environments into the Harris P25 CAP lab environment can be done with suitable effort, care, and due diligence. The challenge Harris sees is the operational practicality of the integrated environments. The concern is the coordination and interruption of the flow and interaction of the normal activities in the product development and SVT environments to accomplish the P25 CAP conformance testing. Repeated interruptions for P25 CAP conformance testing for the various

[22] Per Mr. Orr's written testimony for this hearing, "The PSCR program serves as the technical lead for several Administration initiatives focusing on public safety communications, most importantly the Department of Homeland Security's (DHS) Office for Interoperability and Compatibility (OIC) within the Science and Technology Directorate." For more information on PSCR see the website: http://www.pscr.gov.

[23] Mr. Orr's statement starting at line 1201 of the 5.27 hearing transcript: "We realize that any additional testing that is placed on industry is going to cost money and so we have done everything within this program to ensure that we are minimizing the burden on industry, minimizing the financial requirements that are needed to put the program in place"….

near-final versions of software before final release could have an undesired impact on the product and system software release schedule. While still under evaluation, Harris, at this point, would likely favor performing the P25 CAP conformance testing after the product has been developed and ready for release in the separate P25 CAP lab environment. An earlier concern about CAP testing of the final product because some P25 CAP conformance tests are invasive and require special software test code that would undesirably reside in the final product has been alleviated. The recent practice in the TIA-P25 and NIST/OLES groups has been to not include any invasive tests in the P25 CAP.

c. Harris Summary and Business Perspective for P25 CAP ISSI Conformance Testing

Harris supports a solid, practical DHS P25 Compliance Assessment Program (P25 CAP) and associated testing for the benefit of our customers, other public safety agencies/users, and manufacturers. Harris agrees with Mr. Orr's statement that there is a provision in the P25 Compliance Assessment Laboratory guidelines that would allow "recognized" conformance testing during product development if done with the "right" equipment and quality system in place. The Guide6 "discusses an approach of integrating recognized P25 CAP compliance test activities with the Product Development organization design validation testing activities." While Harris continues to evaluate the integrated approach, Harris is concerned about the operational practicality of integrating the product development environment into the P25 Compliance Assessment Lab environment in compliance with the Guide and NIST Handbook 153 and the business investment impact to do so. The practicality and investment challenges include establishing the "right" test equipment (including software test tools) and the quality system per NIST Handbook 153. Regarding the "right" test equipment, for conformance testing for interfaces like the Common Air Interface (CAI) where commercial off-the-shelf test equipment like protocol analyzers and RF test equipment exists that can be readily validated per NIST Handbook 153, establishing the "right" test equipment is not a challenge. However, for conformance testing for interfaces like the Intra-RF SubSystem Interface (ISSI) where the ISSI product is primarily software and where commercial off-the-shelf software test tools that can be readily validated per NIST Handbook 153 do not exist, establishing the "right" test equipment is a significant challenge. Establishing a Quality Management System for integrating elements of the product development and SVT environments into the Harris P25 CAP lab environment can be done with suitable effort, care, and due diligence. The challenge Harris sees is the operational practicality of the integrated environments. The concern is the coordination and interruption of the flow and interaction of the normal activities in the product development and SVT environments to accomplish the P25 CAP conformance testing. Harris, at this point, would likely favor performing the P25 CAP conformance testing after the product has been developed and ready for release in the separate P25 CAP lab environment.

In terms of a Business perspective to establish and maintain a recognized P25 CAP ISSI conformance testing laboratory, Harris has conducted a ROM scoping analysis of the total ISSI market and the investment to establish and maintain a recognized P25 CAP ISSI conformance testing laboratory. The ROM scope investment to establish and maintain a recognized P25 CAP ISSI conformance testing laboratory ranges from a substantial portion of the total estimated annual ISSI market to several times the total estimated annual ISSI market. The range corresponds to the situations of establishing and maintaining a recognized laboratory integrated with the product development environment and establishing and maintaining a recognized laboratory separate from the product development environment. Such an investment for either situation would not be justified or acceptable for normal business considerations and practices and especially for testing that Harris believes provides little added value or assurance beyond that already provided by the normal conformance testing as part of product development. Harris believes that a validated 3rd party automated ISSI conformance software test tool as a minimum and likely a 3rd party recognized P25 CAP lab for ISSI conformance testing are critical for the practical implementation of formal ISSI conformance testing per the P25 ISSI CAB in effect and cited earlier. Development and validation of an automated ISSI conformance test tool by the Public Safety Communications Research (PSCR)[8] program (or another NIST/OLES or NTIA/ITS) group or validation of a 3rd

party tool by PSCR for use by industry is an area where the DHS (or PSCR, NIST/OLES, NTIA/ITS) could make a significant contribution toward reducing the burden on the small P25 industry consistent with their intent indicated in the statements of Mr. Orr during the hearing.[9]

Additional Comments

Harris offers the following additional comments to clarify certain areas brought out during the course of the hearing:

P25 Equipment Interoperability:

It was implied that not all P25 certified (vendor self-certification) equipment can interoperate. An example was given where you have three P25 radios from different systems and only two could talk to each other. Harris believes that this is not the norm and that the status of interoperability among P25 equipment from various vendors is very good and we testified to that fact. Land Mobile Radio systems are complex and one could say that each system deployed is custom to that user. This presents challenges in how a particular system is configured. We have testified that many times inconsistencies are a result of how a radio system is configured versus whether or not the equipment meets the standard. We should also point out that currently P25 systems of one frequency can not interoperate with P25 systems of a different frequency regardless of whether they pass testing. This is being addressed by the in-place ISSI standard.

Completion Status of P25 Standards:

In the context of the hearing subject, "Interoperability in Public Safety Communications Equipment," Harris believes it is important to state the completion status in terms of the interfaces that are critical and fundamental to system and equipment interoperability. Harris agrees with Dr. Boyd's DHS S&T testimony that the CAI (conventional and trunked) and the ISSI are the interfaces critical and fundamental to system and equipment interoperability. Per Mr. Orr's PSCS testimony, "To date, only the conventional portion of the CAI and the Inter-RF-Subsystem Interface have a completed suite of documents as defined above. The more complex trunked CAI continues to lack conformance test documents (crucial for uniform implementation) although trunked CAI products have been sold for almost a decade." From this view and using the five standards documents per interface for completion per the Mr. Orr written testimony, the P25 standards completion status for the interfaces critical and fundamental to system and equipment interoperability is pretty solid:

- Conventional CAI – 5 of 5 documents complete – 100% Complete
- Trunked CAI – 4 of 5 documents complete with conformance to be completed – 80 % Complete
- ISSI – 5 of 5 documents complete – 100% Complete.

For this analysis, 14 of 15 standards documents are complete; i.e., 93 % Complete.

In addition, for the trunked CAI interoperability as reported in the Harris written testimony, multiple radio products and infrastructure radio products have demonstrated a high functional level of interoperability through the formal CAI interoperability testing as part of the P25 Compliance Assessment Program (CAP) over the last year. As of May 2010, twenty vendor radio products (or radio model classes) from four vendors (EF Johnson, Harris, Motorola, and Tait) have approved Suppliers Declaration of Compliance (SDoCs) and Summary Test Reports (STRs) posted to the official RKB website for information and review by public safety agencies and practitioners. To have passed the trunked voice interoperability standard for these tests, each P25 radio needed to pass 20 tests in the standard on at least three different manufacturer's system infrastructure. It is for these reasons of standards completion status above and the cited trunked interoperability testing results that Harris stated in its testimony that the P25 product standards, the testing standards, and the product features are in place or soon will be in place to enable a solid level of P25 trunked and conventional systems interoperability.

Standards pace is at full industry support capacity:

While some not involved in the standards development process might comment that standards development takes a long time, the TIA process, like other Standards Development Organizations, is a consensus-based

process by design. The standards are developed by top engineers from industry who have the knowledge and perspective to assure successful product implementation to the standard. Getting to consensus and developing the requisite detail of the standard takes time, but the resultant standard product is technically solid and long lasting. Harris believes that since 2005, the standards pace is at full industry/user support capacity. As a rough estimate, there are less than 25 top engineers in this industry with the knowledge, perspective, and capability to develop credible Project 25 standards. Since 2005, there have been approximately 23 week-long, face-to-face TIA & P25 meetings with over 40 working attendees per meeting amounting to ~37,000 person hours or over 23 person years. In addition, there have been over 10 hours of subcommittee or task group conference calls per week over this period with over 10 people participating amounting to ~ 28000 person hours or over 17 person years. In addition, the preparation time of technical document contributions is done outside of the conference call and meeting time. Since 2005 over 13,000 contributions toward the TIA-P25 suite of standards have been submitted for review, critique, and edit. Without researching the TIA records for years 2005-2007, over 75 documents have been formally balloted as a standards documents and over 60 documents have been published as TIA-P25 standards in the 2 ½ years since 2008 through the present time in 2010. Hence, the Harris view that the standards pace is at full industry/user support capacity.

On-site Compliance Assessment Labs:

There was testimony about voluntary testing programs for P25 systems. Both Harris and Motorola testified to the fact that they both have established Compliance Assessment Laboratories and have hosted multiple vendors. Harris testified that it has invested significant resources in support of the P25 standards process. We should highlight that in addition to time, personnel and the costs associated with these standards activities, Harris spent close to $2M to establish an in-house test capability including capital and operating/development costs. It is in the vendor's best interest to deploy compliant equipment. As Chief Johnson testified, most systems are procured through a process that ensures that all equipment is operational before the system is approved for first responder use. Established testing paired with the strict requirements of the procurement process ensures positive results.

As noted during Harris' oral testimony, the P25 industry is small by comparison to the commercial industries of cellular, WiFi, and Bluetooth mentioned by Mr. Orr in his written and oral testimony. To illustrate the total 2009 North American Land Mobile Radio market is estimated to support 12 million users of which 4 million represent public safety users. The P25 industry is estimated to be about half of the total with about 1.5 million users. In contrast, the total 2009 US cellular market is estimated to support about 270 million users/subscribers. The P25 market is about 0.5% of the commercial users/subscribers. Given the scale difference of the P25 industry with a commercial industry like cellular, Harris believes that comparisons and expectations for the P25 industry in terms of the rate of standards development and industry-led compliance assessment are not relevant.

Beyond P25:

Complete ubiquitous interoperability among existing narrowband LMR systems will not be achieved through deployment of P25 equipment alone. As Dr. Boyd testified, public safety has an installed base of radio systems equal to approximately $100 Billion. These systems are of varying ages, operating frequencies, mode, etc…. Other than cost, there are many considerations when procuring a radio system; some of which are size, use, geography, spectrum availability, future proof, etc… There are smaller, rural entities today that do not have the funds to upgrade to an expensive digital system yet may be the central site of a manmade or natural disaster and will need to interoperate with other first and second responders during an incident. To address the unique needs of public safety entities and to achieve varying levels of interoperability, vendors provide a wide array of products from P25 radios and infrastructure to Internet Protocol (IP) networks that connect disparate systems through standardized network architecture.

Hearing - September 23, 2010

Progress on P25: Furthering Interoperability and Competition for Public Safety Radio Equipment

Opening Statement By Chairman David Wu

Good afternoon. I would like to welcome our witnesses, and everybody who has joined us, to today's hearing.

This is the second hearing the Subcommittee has held on the interoperability of public safety communications equipment, and I am glad we have the opportunity to revisit this important topic.

The ability of first responders to communicate with each other during an emergency is vital. As reports have shown, in many major disasters, including 9/11, response efforts have been hindered or imperiled because emergency officials responding from surrounding jurisdictions could not use their radios to communicate with each other.

While many factors contribute to this lack of interoperability, equipment based on proprietary technology makes the situation far worse. Without a common technical standard, there is no assurance that equipment from one manufacturer will work with equipment from another manufacturer. This means that first responders may not be able to communicate with each other when it matters most. And it means that public safety agencies may be forced into buying the various components of their public safety communications systems from a single manufacturer, limiting competition and driving up prices.

In 1989, the public safety community and other stakeholders set out to create a common technical standard for public safety radios, known as the P25 standard. Although progress has been made over the last 20 years, the P25 standard is not yet complete.

At our hearing in May, we learned about disagreements among some of the players in the P25 standard process over the status of the standard and the degree and rigor of testing that should be required. While these disagreements are on highly technical and complicated issues, they have real-world implications for our first responders and those in harm's way. Simply put, our local public safety officials need the certainty that a standard provides and, right now, that certainty does not exist.

I am pleased that we have the opportunity today to hear from people who build, test, and operate P25 equipment. I hope to learn from our panel about how technical disagreements over document status and testing impact interoperability and competition for public safety radio systems.

Local, state, and federal public safety agencies spend billions of dollars on communications equipment. The size of this investment and the mission-critical nature of this equipment make it imperative that P25 fulfill its goals.

Testimony of

Ellen O'Hara
President and Chief Executive Officer
Zetron, Inc.

Before the
United States House of Representatives
Committee on Science and Technology
Subcommittee on Technology and Innovation

Hearing on
"Interoperability in Public Safety Communications Equipment"

September 23, 2010

Chairman Wu and members of the Committee, thank you for this opportunity to offer testimony on Project 25 standards and their implementation in public safety radio systems.

I am President and CEO of Zetron, a manufacturer of public safety communications equipment.

Zetron has been serving the communications needs of our nation's public safety agencies for over 30 years. With several thousand installations worldwide, we're the largest independent manufacturer of interoperable dispatch consoles in the nation.

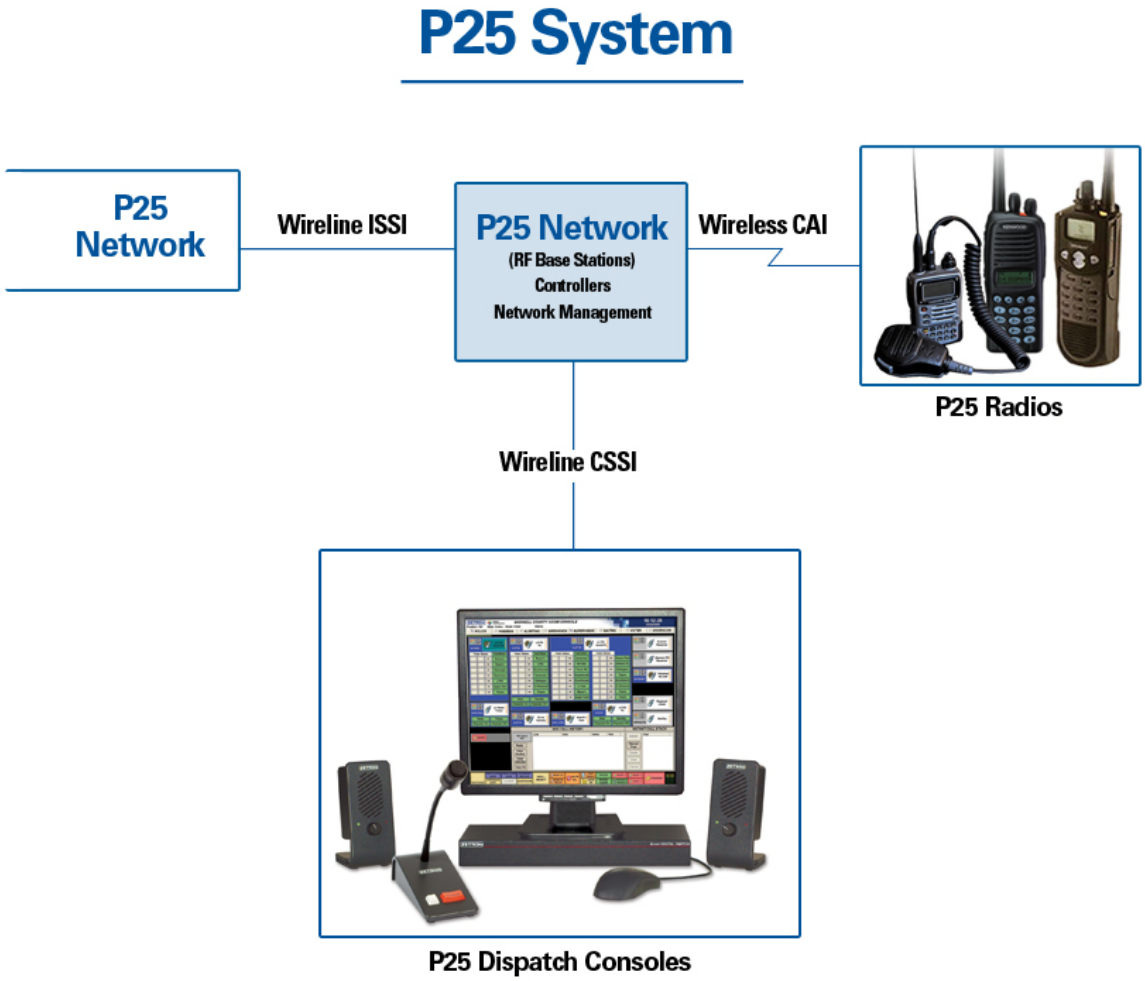
I appreciate the opportunity to testify to the Committee regarding the Project 25 standard. We feel that Project 25 (P25) is critically important to public safety. Zetron is in agreement with the goals of P25. Our company was one of the early signers of the P25 Memorandum of Understanding (MOU), and we have been an active participant in the P25 standards-development process for the past decade.

Chairman Wu, you asked me to address two questions concerning P25:

First, what challenges has Zetron faced integrating our products with those of other vendors, and how has this impacted our customers?

Second, what recommendations would Zetron make to ensure that the P25 process helps foster competition in the marketplace?

In order to put my answers into context, I'd like to refer you to the following graphic.



This is a highly simplified depiction of a P25 system. It includes the P25 network, the dispatch console, radios that are used on the system, and the interfaces that connect these components: the Common Air Interface (CAI), the Inter Subsystem Interface (ISSI), and the Console Subsystem Interface (CSSI).

In your first hearing in May, you focused on radio-to-radio interoperability and competition, which is achieved in P25 through the wireless Common Air Interface.

All P25 network manufacturers in the United States have adopted the CAI standard. As a result, their systems are compatible with all P25 radios, regardless of the radio vendor. In this case, competition is well served—it gives customers more choices and better value.

Different circumstances affect competition on the wireline side, where dispatch consoles are connected to the network.

To support competition on the wireline side, two standards have been created. One is the Inter Subsystem Interface—which provides an interface between two different vendors' P25 systems.

The other is the Console Subsystem Interface. The CSSI provides a seamless wireline interface between the dispatch consoles of one vendor (such as Zetron) and another manufacturer's P25 network.

The CSSI ensures that the customer has a choice in their selection of dispatch consoles. This is important because the dispatch console is the heart of a public safety communication system. It connects first responders, such as police officers on their beat, to the public safety communications center. The console also supports interoperability among radios by patching together radios that use different frequency bands.

Because dispatch consoles play such a critical role in a communication center, customers are best served when they have the freedom to choose the console that best meets their needs and cost requirements. Without a CSSI standard **and** the adoption of that standard by the P25 network vendor, the

customer's choice is limited to the proprietary console provided by that network vendor.

There are several reasons why the adoption of the CSSI standard by P25 network vendors has been slow.

Each P25 interface is defined by a "suite" of standards documents that specify how the interface is to be implemented, tested and verified. The critical documents, which define the CSSI and how to implement the standard, are complete. Due to other priorities in the standards process, the Telecommunications Industry Association (TIA) has not yet finished the testing and verification documents. [1]

This situation has given some P25 network manufacturers reason to delay the implementation of the CSSI in their network offerings. A customer who purchases a P25 network from one of these vendors today has no choice but to purchase the network manufacturer's own proprietary console.

Zetron has invested considerable resources to implement the P25 CSSI wireline standard. But today our CSSI-enabled consoles are currently able to connect to the networks of only three of the seven network vendors' equipment—Tait Radio Communications, EADS North America, and Raytheon. The other network manufacturers have not yet publicly adopted the CSSI, and thus proprietary consoles are the only choice available to customers of those networks.

We are concerned that competition and customer choice are limited by the slow adoption of the open-standard CSSI. Indeed, the lack of the widespread adoption of the CSSI has led some of Zetron's customers to delay their transition to P25, which in turn negatively impacts both competition and interoperability.

We feel that incentives are needed to solve this problem. To that end, I would like to offer two recommendations that could help eliminate some of the obstacles to competition.

- First, we believe that the completion of the full suite of published standards for P25 wireline interfaces would remove a significant roadblock to their adoption. To hasten the completion of these standards, we recommend that the federal government consider issuing grants to manufacturers so that they can allocate the resources necessary to complete the standards. This would allow a manufacturer such as Zetron to provide dedicated engineering resources to the TIA for the purposes of completing these standards.

- We also recommend that the federal government set a date within the next 12 months, after which it will no longer fund, through grants, the purchase of P25 networks that offer **only** proprietary console interfaces rather than the open-standard CSSI. This means that if the offered P25 network equipment can support consoles, that equipment must also support the open-standard CSSI; otherwise, it is ineligible for purchase using interoperability grants.

In closing, I would like to reiterate Zetron's strong support for the objectives of Project 25. We believe that policies that support the completion and adoption of open-standards wireline interfaces such as the CSSI will help ensure that P25's goals of interoperability and competition will be fully realized.

Chairman Wu, and members of the Committee, thank you again for the opportunity to testify before you on these important topics.

Note

1. Why Are the P25 Standards Taking So Long?

This is perhaps the most frequently asked question regarding P25. When asked, it is often in comparison to other wireless communications standards, such as cellular or even Europe's narrow-band public safety standard called TETRA.

We believe that a significant portion of the answer to this question lies in the scope of P25. P25 is unique among all other wireless communications standards in that it includes open, published standards not only for over-the-air protocol and data dispatch consoles to P25 networks (via the CSSI), and to accommodate the unique need of cross-band interoperability (via the ISSI).

While other standards may identify similar interface points, only P25 has gone to the extent of creating standards for these interfaces. This is to ensure that the needs of our nation's public safety agencies are met. Thus the scope of the P25 standard is at least twice that of other wireless communications protocols. In addition, some of the other wireless standards, particularly cellular, were able to leverage the substantial number of existing telephony standards. Land mobile radio, with its unique push-to-talk and selective signaling characteristics, is not able to use telephony standards to the same extent.

Another reason it has taken longer to produce P25 standards is the collaborative, cooperative, and consensus-based approach used. While P25's requirements are identified by its users, as it should be, the actual development of standards to meet those requirements is done mostly by manufacturers.

P25 may not be unique in this approach; some cellular standards have also developed in this way. But being a much smaller market with smaller revenue potential and fewer participants, the amount of resources applied by P25 manufacturers has been relatively small compared to those of cellular manufacturers. In the case of European mobile radio standards, many of these have had external funding and participation by European governments.

Finally, the needs of our nation's public safety users are not static, but continue to evolve. For this reason, Project 25 has always been dynamic, with standards that can be extended and modified to meet emerging needs.

Thus P25 has grown beyond its original vision of the 90's which is "complete," (Phase 1), and is now nearing completion of a Phase 2. In this sense, P25 will not be complete until it is replaced.

Progress on P25: Furthering Interoperability and Competition for Public Safety Radio Equipment

Statement by:

Tom Sorley
Deputy Director Radio Communications Technology
City of Houston

before the

Subcommittee on Technology and Innovation,
House Committee on Science and Technology

September 23, 2010

Hello, my name is Tom Sorley. I am the Deputy Director of Radio Communication Services for the City of Houston. I also serve as the Chair of the Technology Committee for the National Public-Safety Telecommunications Council and as Vice-Chair of the Governing Board for the Department of Homeland Security Project 25 Compliance Assessment Program.

I am leading the City of Houston's efforts to implement one of the largest P25 radio systems in the Country. Once completed, the system will be one of the first to implement the newest version of the P25 standard known as Phase 2. This newest version of the standard was created to operate with double the frequency efficiency of the currently deployed Phase 1 systems. This efficiency is paramount for large metropolitan areas such as Houston which suffer from severe spectrum shortages.

Designing, building, and operating a P25 radio system can be a big challenge. The standard is actually a suite of standards that has hundreds of sub-elements. Most people that are writing specifications to buy a new system do not know enough about the P25 suite of standards to even properly document their requirements. In fact, most just specify that the technology must be P25 compliant. They fail to specify individual elements that must be complaint and the result is that systems are sold as P25 complaint when many parts of the system that could be standards-based remain proprietary.

The City of Houston has more resources than most agencies in the country and therefore we were able to employ one of the largest consulting firms in the public safety communications industry. However, even with our expertise and the assistance of our consultant, there were still items that we missed related to the P25 standard. Imagine the challenges facing small rural public safety entities. I believe this is due to the complexity of the standard and the ever changing elements that make up the standard.

The P25 standards development process has been going on for more than 20 years. As mentioned previously, there are many elements to the standard and several interfaces that all must be fully defined. While this work is being done, technology continues to change. In fact as the years pass, the rate of technology change is increasing. Further complicating the process are regulatory changes, such as frequency efficiency rules, that must be addressed in the standards development process. While it is true that technology standards must be constantly updated, some better way of delineating the P25 standard must be developed.

It would be very helpful if the P25 process created versions that could be easily summarized. (example P25 version 3) This version number would allow agencies to know what is included as part of the P25 standard and more importantly what is not included. This is done in other technology standards such as IEEE 802.11 which is a widely accepted standard for wireless local area networks. The 802.11 standard has many versions delineated by different letters of the alphabet. Although consumers don't necessarily understand the difference between 802.11a and 802.11n, they can easily understand that a product is compliant to one version or the other. The bottom line is that P25 has so many moving parts comprised of many different standards within the suite of standards that the lay person would have no real way of determining if the products they are buying really conform.

The three key aspects of Project 25 that make it particularly important for improved communications interoperability:

1. The initiative was begun and is driven by public safety agencies and organizations.
2. It proceeds with both a vision of forthcoming technological change and the need for graceful migration between technologies used by public safety.
3. Competition founded on open standards would produce the best technology, at the best prices for pubic safety agencies.

Driven by Public Safety Agencies and Organizations

Over the years, public safety involvement in the P25 standards development process has become harder and harder to maintain. Some key public safety representatives have been involved virtually from the beginning of the process. However, the number is small and the involvement of others is limited at best. Vendor representatives vastly outnumber public safety. Most of the major vendors have several people that dedicate a substantial portion of their work time to participate in P25. In reality, this means that the standard is being driven by the active participants – vendors.

The P25 standard development process is set up to encourage consistent participation from both vendors and public safety officials. While this seems like a valid approach, travel restrictions on local public safety representatives often leave them unable to consistently attend making them ineligible to vote on key items. Also, the P25 Steering Committee only has two of the initial public safety representatives who have never been rotated, leaving the impression that they have become more partial to the vendors' perspectives on key issues.

The process could be improved by providing more public safety representation on the Steering Committee and by creating limited, staggered terms for those representatives.

Technology Change and Graceful Migration

As previously discussed, the pace of the standards development process is slow. The rapid pace of technology change further slows the completion of this complicated suite of standards. Also, in some cases, it is in the best interest of the vendor community to have parts of the standard lag as this creates an unmet need that must be filled with a proprietary option. For example: The P25 standard has provisions that allow vendors to offer proprietary features/functions provided there is not an equivalent feature/function mandated by the standard. This serves as a motivator to slow the process down.

P25 Competition

Competition is hampered by a lack of understanding by public safety agencies. The only consistent P25 education effort is conducted by the P25 Technology Interest Group (PTIG). This group is made up of vendors and public safety representatives that are charged to promote the success of Project 25 and educate interested parties on the benefits that the standard offers. As indicated in their purpose statement, this group is focused on the success of the standard. I

believe that a group needs to be established that is focused solely on the education and success of public safety agencies using or contemplating the use of P25 equipment.

This public safety education effort should be focused around helping local, state, and federal agencies understand the standard by creating outreach materials, draft requirements language, draft purchasing language, and draft contract language. It would seem that the existing partnership between DHS and OEC in the P25 CAP could be expanded to include this new role. However, to be effective this effort must be undertaken seriously and appropriately funded.

Competition is not encouraged by manufacturers. P25 manufacturers often try to sell proprietary features that reside on top of the basic P25 operation of the radios in order to force future sales of their products. Some examples include very simple encryption algorithms that are proprietary and appear to solve a problem for local agencies by providing a cost-effective alternative to standards-based encryption that typically costs several hundred dollars more. However, new entrants into that system, or existing agencies on that system that need radios, are forced to remain with that particular vendor to maintain interoperability with the existing radios that utilize the proprietary encryption. Radios on systems are rarely replaced in mass. Therefore, an initial decision on proprietary options has far-reaching impact for years to come.

Another example of this practice is making accessories that are dependent on particular radios and/or other related items. Years ago, siren controls in police cars were integrated into mobile radios to make the user experience easier. However, compatibility ultimately became an issue as a result most public safety agencies de-coupled siren controls and radios in the late 1980's. Recently, our vendor proposed that we consider using a new integrated control head for our radios. The users were very interested in the device as the functionality and ease of use met most of their needs. However, the control head would only operate that particular vendor's siren control package. This would have forced us into a proprietary relationship with radios and related sirens limiting our future buying options. We chose to pass on the option.

P25 Compliance Assessment Program

The DHS CAP is a relatively new program that endeavors to ensure that products marketed and sold to public safety as P25 actually adhere to the standard. Years ago, the P25 participants produced a paper on compliance assessment that established three types of tests to prove compliance:

1. Performance – This test ensures the device performs to the specifications.
2. Conformance – This test ensures the device adheres to the P25 standard.
3. Interoperability – This test ensures the device seamlessly interacts with similar devices.

The P25 Compliance Assessment Process and Procedures Task Group (CAPPTG) drafts Recommended Compliance Assessment Tests (RCAT). These RCATs are used as input documents into the DHS CAP program. The National Institute of Standards and Technology (NIST) participates in P25 and provides input to the CAPPTG to consider in the development of RCATs. However, like public safety representatives, NIST is outnumbered by vendors on this

task group. In the past two years, several critical votes have been divided down the line of vendors versus public safety. Each of these votes was decided in favor of the vendor position.

The DHS CAP program created and published the first Compliance Assessment Bulletin that was based substantially (but not completely) on the RCAT from the CAPPTG. Subsequently, the CAPPTG changed its stance and said that Conformance testing was no longer needed. Instead, they advocated replacing conformance testing with enhanced Interoperability testing. The CAP Governing Board and several leading public safety agencies objected to this change. Eventually, the manufacturers acquiesced on this in regard to the Inter Subsystem Interface (ISSI). In fact, some of them testified earlier this year at this sub-committee stressing that they were committed to the CAP program and would continue to participate even if conformance testing were required.

Over the last several months, those same vendors are reverting back to their previous stance on Conformance testing. They have asserted that the testing is too complicated, expensive and burdensome. This is their position even though NIST has created a test and developed a test tool that is easily adopted. In meetings earlier in the year, one vendor stated that they already run ALL the conformance tests during development making the need to repeat them unnecessary. None of the other vendors in attendance at that meeting raised an issue with that statement. If the vendors already run ALL the conformance tests during development and NIST has develop a test while publishing all the applicable test code, why is it that conformance testing is still too complicated, expensive, and burdensome? If developing a test tool to perform conformance tests is too onerous for the vendors, DHS should charge NIST to expand their support of the CAP program by developing the tests and making them available to the test laboratories.

The DHS CAP work plan has been largely driven by the availability of RCATs from the CAPPTG. This is based on the assumption that the P25 process contained the largest collection of P25 experts making it the logical place for test requirements development. Again, NIST and public safety representatives are involved in that process. However, development of RCATs can be delayed based on any number of factors. As an example, P25 trunked radios have been sold in the market place for more than 10 years but there is not one RCAT available that includes conformance tests for trunking functionality. The CAP governing board would like to develop and release Compliance Assessment Bulletins establishing the testing of P25 features prior to or in concert with those features entering the market place. We have a great deal of catching up to do, but it clear to us that we may have to develop an alternate process that is not dependent upon the P25 CAPPTG developed RCATs.

Most major public safety associations have publically advocated for retaining all three types of tests: performance, conformance, and interoperability as each play a key role in determining if a product is compliant. First responders must be able to predict with certainty what the device they use will perform as expected. It is imperative that each type of test be performed to make sure.

One complicating factor in the DHS CAP is the fact that it is voluntary. No vendor is forced to participate. To date, most vendors do participate, but during the disagreement over conformance testing of the ISSI several vendors informally indicated that if conformance testing was pursued, they would simply not participate. If all the vendors chose to opt out of the process, the process

dies. DHS has included a requirement in the Federal Grant Guidance that requires any P25 equipment purchased with grant funds must have a Suppliers Declaration of Compliance (SDOC) on file on the Responder Knowledge Base (RKB) website. However, there are creative ways to get around this requirement. For instance, I heard a story last month that a vendor was willing to give away certain features as "add-ons" to avoid the SDOC requirement. I am not sure if making P25 CAP a mandatory requirement is practical, but it should be investigated.

Why not just use Cell Phones?

Recently, Reuven Carlyle a State Representative from the Seattle, Washington area posted an entry into his blog entitled, "Want Government Reform? Idea #3: A new public safety communication strategy." (Attachment A). In this blog post, Representative Carlyle asserted (among other things) that P25 radios are too expensive and public safety would be better served using cell phones. He asserts that US public safety agencies pay many times more for their equipment than do their counterparts in other countries. While some points in the blog on the surface appear to be true, they are not presented in context.

Several days after Rep. Carlyle's blog, Bill Schrier, CIO of the City of Seattle drafted his own blog entry in response. (Attachment B). In Mr. Schrier's post, he points out many of the flaws in the original post by Rep. Carlyle. I agree with all of Mr. Schrier's points. Simply put, public safety has several requirements that can't possibly be met by cellular devices. Network priority, reliability, availability during disasters or weather events, talk-around mode, and ruggedness are several of the requirements that public safety radios need and cellular devices and systems can't provide.

I have the responsibility of buying these devices for the City of Houston. I would love to be able to purchase a cellular phone that met the needs of public safety. However, one does not exist and it is quite unlikely that one will exist in the foreseeable future.

I would like to thank Chairman Wu for inviting me to testify today. On behalf of public safety and the City of Houston, I would like to commend the work of the sub-committee as it relates to public safety communications and encourage you to continue to weigh in on this important topic.

Attachment A

Want government reform? Idea #3: A new public safety communication strategy

By Reuven Carlyle
September 6, 2010

Have you ever noticed how police officers carry both a cellular phone and a hand-held radio? It might surprise you to learn that you are paying hundreds of times more for the radio than the cell phone. And you're about to pay millions more unless we have the courage to change course. Even the New York Times is starting to agitate.

When I joined McCaw Cellular Communications in the early 1990s—one of the world's most entrepreneurial companies—less than 10 million Americans had mobile phones. They were big, clunky and had no data capability. Today there are as many mobile phones as people, prices have fallen and consumers have benefitted from innovation that led to iPhones, Windows Mobile, Droid and other robust platforms. The change has been technically disruptive and positive. In that same time, the nation's public safety community—law enforcement, fire, EMS—has also spent billions of public tax dollars on new infrastructure and yet the quality, cost and functionality of their expensive, proprietary, two-way radios has not materially improved since the 1970s.

Now, the taxpayers of Seattle, King County and Washington State are being asked to spend up to hundreds of millions more for a brand new radio system for police, fire, EMS and other emergency workers.

In Seattle and King County alone my gut check is that the cost will be in the $50 million to $250 million range. Since I'm not on the inside I don't know if this is close or far from the truth, but my gut is that it's uncomfortably in that range. And that says nothing of our friends in Pierce, Snohomish and other

communities who are struggling through a similar journey. And Oregon is much further down the same pathway and is now politically panicking in the face of a $600 million bill.

It's time for courageous honesty: In my personal view, the decision is the wrong direction technically, politically, and financially.

The uncomfortable truth is that for city, county and state governments public safety radio equipment costs between 10x and 100x more than it does in most other countries, despite the U.S. leadership position for wireless technologies such as smartphones, WiFi, WiMax and more. Even Seattle, in many ways the hometown of the consumer wireless industry, will pay tens of millions for a proprietary new police radio system.

The reason is that the nation's public safety communications market does not enjoy healthy, vibrant, market-based competition in any way comparable to consumer mobile services

First of all, it is important to acknowledge that we must ensure our police, fire and EMS officials have access to high quality emergency communication systems. Unfortunately, we must upgrade the hardware-based system because the current vendor for the Seattle and King County system, Motorola, has made a business decision to end support for the current network.

In fairness, they told us long ago they would eventually turn off our system, and we needed to buy their next generation system (or conceptually their competitor's system). Unlike in the consumer market, we may have purchased the equipment, but the company retains the right to determine how long our system is supported. It's not much of an exaggeration to say that it's sort of like Verizon asking consumers to directly fund new cell towers and network and then forcing everyone to buy new mobile phones because the company wants to upgrade their internal network capabilities.

Second, our nation's first responders and 9-1-1 dispatchers aggressively moved to establish an industry standard for first responders called "P25" to get better radios at lower prices, to break the monopoly of the current structure. Unfortunately, more than 25 years later, P25 is still not available, still not implemented and even the Chairman of the FCC recently jolted Members of Congress by acknowledging "…[P25] has taken more than 20 years to develop and is still not complete" and "the protracted development of P25 has allowed vendors to take advantage of selling proprietary solutions."

The industry knows that P25 isn't, in fact, truly standards-based and has resulted in even more expensive radios, not the other way around. If our state's march toward P25 continues, it will be more business as usual – and first responder radios will still cost $5,000 each. (Did you catch that? Just one P25 radio for one police officer costs $5,000 and yet it has less processing power and functionality than an iPhone, Windows Mobile or Droid phone).

Yet with few exceptions that is exactly where our current 'group think' in Seattle and King County is leading.

Third, some local Seattle and King County officials have recently applied for the Obama Administration's plans for broadband across the nation utilizing "4G" or "LTE" technology on 700 MHz… for the Seattle area. Their position is inspired in part because the broadband system would help first responders. And yet The National Broadband Plan, as written, doesn't help with voice communications—the most essential element for police, fire and EMS officials.

This isn't a modest technical decision, it's a major policy choice facing King County Executive Dow Constantine and the county council as well as Mayor Michael McGinn and the city council.

Here's a picture of where Seattle and King County are headed if we don't change direction: The first 4G or LTE system built in the U.S. for first responders is already underway, in the San Francisco Bay Area – a geography and population similar to our own. The federal government is fronting the $50 million it will

cost, and the result is that 300 public safety vehicles will be equipped with 4G data modems. That is $167,000 per police car and fire truck, for video to and from the scene.

At the same time the consumer marketplace—AT&T, Verizon, Sprint and T-Mobile—provides virtually the same mobile service at a fraction of the cost at equal or higher service quality levels in many cases. Public safety is building their own mirror system to commercial services. A mirror system that is on track to be proprietary, closed, and expensive like our existing first responder radio systems.

Of course consumer cellular phones are not perfect nor always a technically viable alternative, and they are by no means a simple alternative, but philosophically they demonstrate the profound value of market-based competition.

I am willing to bet a private tour of the State Capitol building that if you ask 20 police, fire and EMS officials to choose between their cellular phones and their two way radios, the majority will choose to hold onto the former. Their mobile phones are easier, more flexible, equally as reliable in most cases and now support data.

Without question it's important to acknowledge that technically cell phones do have limitations – in basements, rural and other "out of coverage" areas they won't provide essential voice communications for first responders. But the very important and dirty little secret is that neither do the P25 radio systems, or the 4G/LTE systems. Our first responders need handsets that utilize the high feature / low cost advantages of open market cell phone systems, but also work in basements "peer to peer" when out of range of the system. And that solution still shouldn't cost $5,000 for each and every single radio.

While it is true public safety radios need to be heavy duty, it doesn't inherently mean they should cost 10 times as much as commercial systems that have more processing power, more technical flexibility and more application functionality.

Yes this is a bit technical and wonky but the financial implications are stunning in scale – as Oregon is experiencing, approaching $1 billion when the costs of all local agencies are included with the first $600 million buildout.

Is it too late? There is a way forward if we have the courageous honesty to tackle old assumptions and myths.

1. We should stop buying P25 radios at literally $5,000 per radio and start buying TETRA radios. TETRA is similar to P25, but it is truly open standard radio used by police and fire departments in Europe and Asia . They offer more features and are tested around the globe… and cost less than $500 each. They are essentially "Nextel-like" in their capability but are a fraction of the cost of the non-open standard P25.

2. We should absolutely back a national broadband plan – but not this one. Not until it is legally bound to an open, public standard that enables true, free market participation from any and all vendors. Not a penny of federal or state funding should go towards any proprietary 4G/LTE solutions, and Seattle and King County public safety leaders should insist on an open standard before launching any 4G/LTE 700 MHz construction in Washington.

3. Let's ask line officers and regular firefighters what they need to do their jobs. They are the users and yet we rarely ask them firsthand what they need to succeed.

4. Investigate the real-deal of the $50 million pilot project in San Francisco, which puts the proprietary 4G/LTE technology in the lead for another 20-year monopoly. Let's understand the implications before Seattle goes down the same expensive route—but likely without the pot of federal money provided to San Francisco.

5. We're not the only ones with this issue. We should ask other regions and states to join us in asking for a market that gives our first responders what they really need, at a price that we can afford.

6. We should have the courage to explore a stronger partnership with commercial mobile operators in underserved areas. We could subsidize the expansion of their networks and provide cell tower sites, for example, in exchange for more sophisticated ‘priority access’ for public safety–and improved service level agreements–and pricing breaks.

Perhaps a stronger partnership with Oregon could save us both hundreds of millions of dollars or more. We can no longer afford a world where each state, each county, each city ‘goes it alone’ in the delivery of ‘utility’ services such as communications. Imagine our buying power united by a technical vision and strategy?

Unfortunately, at the end of the day, we acknowledge we have to buy a new radio system for our faithful and hard-working police, firefighters, and EMTs in the Seattle and King County area.

We as a city, county and state are more innovative, entrepreneurial and technically sophisticated than this. If we believe in government reform and want to display to the public that we have the courageous honesty to seize the opportunity of this crisis, we need to change course even in sacred areas like public safety. We have to question old assumptions, challenge monopolies inside and outside of government, and demand that when taxpayers are paying the bill, there is value for our dollar.

It’s the right thing for the public who are served by our courageous law enforcement, firefighters and EMS officials. And it’s right for taxpayers.

Your partner in service,

Reuven.

Attachment B

Why Don't Cops and Firefighters Just Use Cell Phones?

By Bill Schrier, bill.schrier@seattle.gov
Chief Technology Officer, City of Seattle
September 10, 2010

Police officers and firefighters carry $5000 radios. Local and state governments spend hundreds of millions of dollars to build public safety radio networks. Yet, today, cell phone networks seem to be everywhere, most people carry a mobile phone and many of us think paying $199 for an iPhone is expensive.

Why can't cops and firefighters and emergency medical technicians (EMT) use cell phones like everyone else? A Washington State legislator from Seattle recently public argued for this approach in his blog. And, at first, this appears to be a simple way for governments to save a lot of taxpayer dollars.

Here are a few reasons public safety officers need their own dedicated networks:

- Priority. Cellular networks do not prioritize their users or traffic. A teenager's cell phone has the same priority as a cell phone used by a police officer or, for that matter, the BlackBerry used by President Obama. We've all experienced "no circuits available" or "network busy" when using a cell phone. When I'm being assaulted or have been injured in an automobile accident or even have had my house burglarized, the last thing I want is to have the network be "busy" so a police officer or EMT couldn't be dispatched. Public safety needs dedicated frequencies where police officers and firefighters have priority and even, perhaps, exclusive rights to for use, without calls being clogged by the public.
- Reliability. Seattle's public safety radio network, part of the larger King County-wide 800 megahertz public safety radio network, handles more than 60,000 police, fire and emergency medical calls every day. It operated last year with 99.9994% reliability - that's about 189 seconds of downtime out of more the than 31 million seconds which composed the year 2009. On the average, only about five out of the 60,000 calls were delayed for any reason, and even then the average delay was about two seconds. What cell phone network has that kind of reliability? How many times have you experienced "no service" or "call dropped" with your cell phone? Do we want firefighters who are reviving a heart attack victim and talking to the emergency room on the radio to all-of-a-sudden have their call dropped? Or should police officers lose service when drunk drivers clog the roads and bars are closing at 2:00 AM because a cell phone company decides to do maintenance because "no one uses the network then"?
- Disasters. Even small disasters cause cell phone networks to collapse. In Seattle, we've had swat team actions or car accidents which have shut down a freeway. Suddenly cell phone service abruptly ceases in that area because EVERYONE is on their phone. A few years ago a rifleman was loose and shooting people in Tacoma Mall. Responding police and EMTs had communications because they had dedicated networks and frequencies, but again cell phone networks were overloaded and down. In a larger disaster such as an earthquake or hurricane (with associated evacuation of large cities), commercial networks will be overloaded or jammed for days by people trying to escape the affected areas. Do we want police and fire departments - or even transportation, electric utilities and public works departments - to be trying to use those same networks while they are responding to the disaster? I don't think so.
- Talk-around. A key feature of most government-operated networks is something called talk-around or simplex or "walkie-talkie" mode. In this mode, individual radios talk directly to each other, without using a radio or cell tower. This is very important at incident scenes -

firefighters commonly use it at the scene of a fire, because the radios will operate at the scene even if there isn't a tower nearby. But this NEVER a feature of cellular phone networks. If the cell tower is down or out of range, that cell phone in your hands is a useless lump of plastic. But the radios of public safety officers still work and will talk to each other even without the tower.

- Ruggedness. No firefighter in his/her right mind would fight a fire using a cell phone for communications. The heat, water and ruggedness of the environment would quickly destroy the device. Yet most public safety radios will survive being dropped repeatedly on the ground or being immersed in water for 30 minutes or more. No standard cell phone can survive the rigorous work of firefighting or policing.

Are there problems with the current dedicated public safety networks? Absolutely.. The use proprietary technologies, for example "Project 25". Theoretically all "Project 25" radios work on any "Project 25" radio system. But only a few of those are deployed around the nation. These proprietary technologies are one reason the radios cost up to $5,000 each.
Representative Carlyle, in his blog, proposes that we deploy "Tetra" radios for public safety. While Tetra is common in some parts of the world, it is not used at all in the United States. This is a dangerous proposal, because it means Tetra networks we buy would not work with the equipment used by any other government or telecommunications carrier anywhere in the United States. If called to respond to a disaster overseas, we could talk to firefighters in Hong Kong or the police in Ireland, however.

Another problem we face is the small market - the total market for public safety is perhaps 10,000,000 radios which are replaced, say, once every 10 years. On the other hand, the cell phone market is huge - 260 million cell phones replaced every two years in the United States alone. The economies of scale means consumers will have a lot more choice, and their cell phones will be relatively cheap.

So is there some way to reduce the sky-high cost of these dedicated public safety networks while at the same time not endangering cops, firefighters, EMTs and the public in general?

Yes, there is.. The FCC, in its national broadband plan, and the federal Department of Commerce, with its forward-thinking grant program for broadband, are lighting the way for a new public safety network which will be more robust, national in scope, and interoperable. By "interoperable" I mean the new public safety equipment will probably operate almost anywhere in the nation, whether on a dedicated government network or on a commercial cell phone network. Here are some features of the new networks:

- The FCC and major public safety organizations have called for the new public safety networks to be built using a fourth generation (4G) technology called LTE - long-term evolution. Not coincidently, this is the same technology which will be used by the major cell phone companies Verizon and AT&T when they construct their 4G networks. The commercial networks will operate on different frequencies than the public safety networks, but they will all be built in same general area of the wireless spectrum - the 700 megahertz (MHz) band.
- Because they are all using the same technology (LTE) and are in a similar slice of radio spectrum (700 MHz) potentially they will all interoperate. That means that public safety officers will use the government networks and frequencies when they are within range, but could "roam" to a commercial network if necessary. So cops and firefighters will have the best of both worlds - coverage from dedicated government networks and coverage from multiple private carriers. The FCC is even considering rules which would require the commercial companies to give public safety priority on the commercial LTE networks.

- Because everyone - consumers, cops, firefighters and even general government workers such as transportation and utilities - are all using LTE, constructing the networks can be much cheaper. Commercial telecommunications carriers could put government antennas and equipment at their cell sites, and vice-versa. Perhaps the network equipment at the cell site, or even the central switches could be shared as well. Public safety will still be using its own frequencies and have priority, but could share many other network elements.
- And the radios used by individual public safety officers or placed in police vehicles and fire trucks can be much cheaper as well. Because manufacturers are all making equipment for the same technology - LTE - it could cost just a few hundred dollars. Again, there will be specialized and ruggedized devices for firefighters and others working in punishing environments, but the "innards" - the electronics - will be much less expensive.
- Next, we have to get all first and second responders to use the same or common networks. Here in Washington State, for example, we have multiple overlapping and duplicate networks. City and County police and fire in the region have one network, each electric utility (e.g. Seattle City Light) have another network. Transportation departments have their own networks (e.g. Seattle Transportation and Washington State Transportation each have their own separate network). The Washington State Patrol has its own separate network. The State Department of Natural Resources has its own network. Fish and Wildlife has its own network. And federal government agencies (FBI, customs and immigration) have their own networks. This is patently stupid and expensive. As we build these new fourth generation LTE networks, we need to build a single network with lots of sites and a lot of redundancy and hardening to withstand disasters. And everyone - first and second responders from all agencies - should use it.
- Finally, and perhaps most importantly, all the networks will be nationally interoperable. The lack of communications interoperability was a major finding of the Commission which investigated the September 11th World Trade Center attack. But with these new networks, a Seattle police officer's 4th generation LTE device will also work on New York City's LTE network or New Mexico's :LTE network or on any Verizon or AT&T network anywhere in the nation. As disasters happen anywhere in the United States, and first and second responders are rushed to the scene of the disaster, they can take their communications gear with them and it will work.

The City of Seattle is one of a handful (about 20) forward-thinking governments leading the way to deploy these new networks. Seattle's public safety LTE network, hopefully launched with a federal stimulus grant, will eventually expand throughout the Puget Sound region and across the State of Washington. The State of Oregon also has authority and a grant request to build an LTE network, and we are working with Oregon to make sure our networks work with each other seamlessly.

Is all of this a pipe dream? I don't think so. A number of public and private companies, governments and telecommunciations carriers and equipment manufacturers are working together to realize it. Many of them are in the Public Safety Alliance. In the Federal government, the FCC is working with the National Institute of Standards and the Departments of Commerce and Homeland security are providing grant funding. It will take a lot of work and many years to realize this network.

But when it is finished, we'll have public safety networks which work to keep us safe, and consumer networks which work to keep us productive and linked to our friends and families. These networks will be separate yet connected. They will be built from common technologies. And they will be less expensive for taxpayers than the networks we have today.

STATEMENT OF RUSS SVEDA
MANAGER OF THE RADIO TECHNICAL SERVICE CENTER
U.S. DEPARTMENT OF THE INTERIOR
BEFORE THE
SUBCOMMITTEE ON TECHNOLOGY & INNOVATION
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
HEARING ON
PROGRESS ON P25: FURTHERING INTEROPERABILITY AND COMPETITION FOR PUBLIC SAFETY RADIO EQUIPMENT
SEPTEMBER 23, 2010

Good Morning, Mr. Chairman and Members of the Subcommittee, I appreciate the opportunity to appear before you today to discuss the Department of the Interior's testing program for Project 25. My name is Russ Sveda. I am the Manager of the Radio Technical Service Center for the Department of the Interior (Department), where we provide land mobile radio systems engineering and product testing for the Department. I have almost 30 years of military and civilian Government experience in radio communications and look forward to sharing my experiences with the Subcommittee.

To provide a little background, because of the Department's broad land management portfolio, the Department has land mobile radios and systems in use across nearly all of the 50 states and U.S. territories. Our operations, particularly in law enforcement and wildland fire fighting, require a high degree of interoperability with other Federal, Tribal, State and local agencies. Our law enforcement officers and fire fighters work in remote locations across the country supporting various incidents, whether at a wildland fire in Alaska, a joint operation with the Border Patrol in the Southwest, or a hurricane relief effort in the Southeast. A clear and concise standard for land mobile radio, and confidence in the products' adherence to those standards, are extremely important to us.

The Department of the Interior adopted the Project 25 Standards in 1996 and has been buying and using products that purport to adhere to this standard since then. Unlike many of the other organizations who contract the design and implementation of a turnkey system, we typically design and install our own land mobile radio systems with components purchased from multiple vendors in order to minimize costs.

Our interest in the Project 25 standards and interoperability goes beyond whether vendor "A's" radio works with vendor "B's" radio and into the land mobile radio "system." Our mission demands that not only must Radio "A", "B" and "C" interoperate on our local system, but our users' handheld and mobile radios must also work effectively on any system in the country. With our in-house system design and implementation, we must further ensure that system equipment from vendor "A" works with equipment from vendor "B" and vendor "C".

The slow pace of the development of the Project 25 Standards has created some frustration in the radio user community. While I applaud the industry for the success in establishing a solid Common Air Interface so that different radios can talk to each other, most of the standards are still in development. We have invested 14 years into this technology and today, we are still not able to design and install a Project 25 compliant "system" without significant engineering and customization.

The Department started testing Project 25 products in 2002 as part of a Department-wide contract. We found this necessary because of the experiences we and our users had with what I would call the "first generation" Project 25 products. Since that time, we have evolved our testing along with the evolution of the standards. Today, we test the Project 25 products offered under yet another contract that supports both the Department of the Interior and the Department of Agriculture.

Our current testing is based on the Project 25 Standards and specifically targets performance, conformance, and interoperability. To use resources efficiently, we select specific tests based on the risk and impact to our users.

Since 2002, we have seen a drastic improvement in the Project 25 products and a significant increase in the number of vendors that can provide those products. There is still a long road ahead.

We envision continuing to test Project 25 products until all the standards are published and the industry has matured in complying with those standards.

The Department is committed to supporting the Project 25 Standards, and we welcome your support and attention to this topic. It is in the best interest of the government and in particular of those who place themselves in harms' way to continue the standards development and independent testing of Project 25.

This concludes my testimony. I am happy to answer any questions that you or the members of the Subcommittee may have.

U.S. House of Representatives
Subcommittee on Technology and Innovation,
House Committee on Science and Technology

September 23rd, 2010

"*Progress on P25: Furthering Interoperability and Competition for Public Safety Radio Equipment*"

Testimony of:
Marvin Ingram
Senior Director
ARINC Public Safety Communications
Annapolis, MD

Chairman Wu, Members of the Subcommittee, thank you for the opportunity to appear before you today to discuss the current state of interoperability and competition in the marketplace in Public Safety radio equipment. It is truly an honor to speak with you today, thank you for the invitation. ARINC support the full adoption of the P25 standards. In my testimony today, I would like to leave you with 3 items for your consideration:

1. Standards drive competition and innovation in any marketplace and it will in Public Safety communications
2. Technology is not a barrier to finalizing the P25 standard - several manufactures are anxiously awaiting completion of several elements of the standards
3. Finalizing communications standards and adoption of compliance and conformance testing is imperative to fully solving the interoperability issue.

I represent a company that has a long history in radio communications stretching back almost 80 years. ARINC was originally formed to manage aeronautical radio frequencies used by the airline industry and we still perform that role today. ARINC has participated in creating interoperability of communications within the aviation industry. ARINC has built and manages a global mission critical network that is used by airlines around world to communicate.

In the aviation industry, many of the communications standards are referred to as "ARINC" standards and they enable voice and data communications interoperability as well as physical equipment interoperability. The standards are far reaching with everyone from airframe manufacturers to rental car companies utilizing them. They enable a pilot to bring you weather forecasts for the destination airport at 35,000 feet, lets a rental car company know you will be late, and enables an engine manufacturer to know when a jet needs servicing automatically.

The tragic events of 9/11 motivated some smart people at ARINC to evaluate how we could leverage our expertise in aviation communications to contribute in solving the

public safety communications interoperability problem. That's when the business unit I represent was formed.

While a relative newcomer to public safety, our track record demonstrates our ability to solve complex problems and deliver mission critical solutions. In the industries and markets where we participate we are viewed by our customers as a thought leader and partner. For the most part we do not manufacture hardware; we use existing components to create new or integrated solutions.
From this background you might infer how important standards are to ARINC. Standards are what enable ARINC to build the integrated solutions we provide to our customers. This is true in every market vertical we participate. The market confusion regarding P25 standards is one factor that has slowed our ability to add real value to public safety customers. Until recently, there were only two vendors where customers could purchase a trunked P25 system. These vendors provide a complete end-to-end system sold through a direct sales model with little to no room for additional vendor participation.

Over the past few years the P25 standard has evolved to the point where more manufacturers are making P25 compliant "*components"* such as subscriber units, consoles, system control software, and repeaters. These smaller companies make very capable products, however they don't make a complete system. As an integrator, we now have the ability to take the components from these manufacturers and build complete systems using a "best of breed" approach. Many of these manufacturers seek ARINC out due to our unbiased approach to designing and implementing public safety systems. ARINC has invested and will continue to invest substantially in the in the testing and delivery of systems that conform to the P25 standard.

This transition from a single vendor solution to the integrated multi-vendor solution is nothing new. The IT industry went through this very transition in the early 90's. The real question from our perspective is why has it taken so long for public safety to get where it is? And why does it seem that it still has a very long way to go?

The P25 standard, started in 1989 just celebrated it's 20th anniversary and it's still not complete. To put this in perspective, twenty years ago the Internet was limited to universities and research companies, PC's were very expensive, slow, and very few people had them, there were no mobile phones, and "high speed" connections were 56kbps dialup. If other industries moved at the same pace as the P25 standard, almost no one would have a portable phone, "portable computers" would cost $10,000 weigh 20lbs, with less than 1MB of disk space, and wireless broadband would still be a pipe dream regardless of the spectrum availability. I say this with some risk of offending the many good folks who put so much effort into the standards as they exist today, for they have developed a worthy baseline. But in large part, many are just as frustrated as we are regarding the pace of development. Overall this has had a negative impact on the ability of first responders to communicate and put the public at risk on both a daily basis and during times of crisis such as on 9/11 and during hurricane Katrina.

"What challenges has ARINC encountered in integrating P25 digital land mobile radio equipment from different vendors? In your experience, how can these technological challenges impact the customer of this equipment?"

ARINC has integrated technology from several P25 equipment manufacturers, including EADS, Zetron, EF Johnson, Kenwood, TAIT and Thales. We are working with several others to get their equipment in our labs so that we can then include them in proposals to customers. We have found these manufactures to be enthusiastic in working with us and each other. We have all collaborated to increase the interoperability of all the products. Many of these manufactures have expressed the desire to participate in ARINC delivered systems as they will be able to compete with one another on a level playing field.

However, as standards have been delayed, competition has been stifled, costs have remained high, and the full potential for interoperability has not been achieved. Vendors of proprietary systems have taken advantage of the delay in standards development to advance their gain in market share. Customers have had to purchase or extend the life of their existing system or systems with proprietary features and function, often at a

hefty price tag, until the standard is developed enough to use. As Mr. Dereck Orr of the National Institute of Standards and Technology testified before this committee on May 27th, 2010 only small but critical portions of the standard have been ratified, and it's only been in the last 2 years that a compliance testing program has been implemented.

The first few years of P25 deployments had many failures with respect to multi-vendor interoperability and finger pointing as to who was at fault. This instilled a level of doubt in the minds of many first responders that has not been fully overcome. In several procurements we've been asked 'How can guarantee that components from various vendors will interoperate?' Even today, as CAP labs attest to interoperability the customer base uses the past as an excuse to stick with the status quo of a single vendor end-to-end solution, of which there are still only two. *To be sure, there are still ways to purposefully deploy a P25 system such that another vendor's equipment will not function on it, but there are also ways to deploy it so that it will and it has been possible for quite a number of years.*

To once again draw a parallel to another industry, most of you know who manufactured your mobile phone, and what carrier you pay your service charges too. How many of you know who made the infrastructure at the local tower site? Do you worry that it's not compatible? Of course not. The reason is the testing that other industries go through to ensure compatibility and the zeal with which they want to ensure their product is accepted in the marketplace.

Another challenge is dealing with the idiosyncrasies of how each manufacturer interprets the standards. This has the potential to cause issues with deployments. ARINC maintains a test and demonstration lab at our headquarters in Annapolis Maryland to ferret out troublesome configuration issues before we deploy systems to the field. We also work with vendors during their development cycles to test new functionality or products in a "private" environment that isn't as sterile as their lab, yet won't impact customers. These vendors also test among themselves to see if they have each come to the same conclusion regarding how to implement technology. The level

of activity in this arena has increased over the last two to three years due to more vendors in the space and recognition that the procurement process if finally starting to shift from single to multi-vendor solutions.

What we have seen is that vendors with smaller market share must and will work harder to prove to the larger vendors and the market in general that their radio will interoperate with the “big guys”. They also work harder to innovate in areas such as ease of configuration, battery life, fireground features, and packaging.

“What would you recommend to ensure that the P25 standards are implemented consistently?”

I believe open standards in public safety communications will increase competition and provide innovative, cost sensitive solutions. We have witnessed this in other industries, but the pace of the current public safety communications standards development process, has in fact frustrated equipment manufacturers who wish to invest in the development and enhancement of their products. ARINC supports accelerating the adoption and implementation of the most critical public safety communication standards and technologies, along with compliance and conformance testing.

- ARINC recommends federal funding be established and managed by a dedicated governing body, to provide grants to public safety personnel, technology vendors and others to participate in the ratification of the published P25 standards.
- ARINC recommends a schedule be established and maintained by the dedicated governing body to ensure completion of the standards in a timely manner.
- ARINC recommends portions of the standards be released in manageable phases.
- Finally, ARINC recommends that this initiative be closely monitored by this and other legislative and regulatory bodies charged with solving the problem of Public Safety interoperability.

Chairman Wu, Members of the Subcommittee, thank you again for inviting me to testify on this very critical issue, I am honored.

Marvin Ingram Biography

Marvin Ingram has served as the Senior Director for ARINC's Public Safety Communications business unit since 2004. ARINC is a Communications Engineering and Systems Integration firm based in Annapolis Maryland. Mr. Ingram has led the development of the strategic plan, technical roadmap and go-to-market strategy for the ARINC Wireless Interoperable Network Solutions (AWINS).

AWINS was developed to provide architecture for a standards platform to provide interoperable communications between Public Safety and Homeland Security agencies. It is designed to provide greater flexibility, resiliency, a choice of vendors, lower costs, and the capability for future expansion. As an industry leader in legacy radio systems interoperability using IP and VoIP, ARINC is known as an integrator that delivers mission critical solutions. In addition to traditional legacy radio integration, AWINS includes APCO P25 radio technology. Focused on standards compliant systems, ARINC is able to deliver end to end communications interoperability.

Mr. Ingram has provided leadership for over 20 years in program management, engineering, quality assurance, customer satisfaction, sales and marketing for Public Safety Communications and IT solutions.

Mr. Ingram started his career serving in the U.S. Air Force as an Electronic Intelligence engineer. Mr. Ingram’s career includes network engineering and executive management in several information technology organizations prior to joining ARINC.